Home within Reach: Designing a New Prefabricated House

Hisako Sato
May 2008

Submitted towards the fulfillment of the requirements for the Doctor of Architecture Degree.

School of Architecture
University of Hawai‘i

Doctorate Project Committee
Barry John Baker, Chairperson
A. Spencer Leineweber
Marja Sarvimaki

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We Certify that we have read this Doctorate Project and that, in our opinion, it is satisfactory in scope and quality in partial fulfillment for the degree of Doctor of Architecture in the School of Architecture, University of Hawai'i at Mānoa.

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ABSTRACT

Prefabricated housing has a brighter possibility for providing a custom, modern home construction that is faster, safer, more flexible, predictable and healthier than the average new home construction. It also has greater potential to produce well designed mass-production housing. With this method homebuyers can build (or purchase) a quality home at a traditional price or possibly at a lower cost, with an exceptional energy efficient and environmentally friendly design.

Today, American homebuyers are looking for more flexible and affordable housing, and are ready for the change from the traditional speculative housing modeled using the "Levittown" concept which was developed nearly 60 years ago and the McMansion which became popular in the 1980's.

There were numerous groundbreaking proposals for prefabricated housing in the late thirties, the forties after World War II, and the sixties, from architects including Le Corbusier, Walter Gropius, Buckminster Fuller, Albert Frey, Jean Prouve, Charles and Ray Eames, and Richard Rogers. However, those ideas were difficult to adapt to common residential design, and were too advanced and modern for the average homebuyers.

Also, today the construction technology for prefabricated houses has advanced. Prefabricated housing will benefit not only architects by providing a bigger opportunity to practice their skills to a wider housing market, but will also benefit the homebuyers who are looking for housing styles which fit their life styles; a home within reach. In this project I would like to propose a housing plan by using one of the notable methods of

construction; the Structural Install Panel System. The project site is located in Novi, Michigan, one of the most recent fastest-growing suburbs of Detroit, Michigan where tract housing, especially McMansions, are built. The city is approximately 25 miles northwest of the center of Detroit, and 100 miles south of Bay City, Michigan where the first company, Aladdin Readi-Cut Houses, offered a true "kit" house 100 years ago.

DEFINITIONS

Adaptability: A structure that has the ability to be modified or extended at minimum cost to suit the changing needs of the people living in the house. Thoughtful design can provide the flexibility for these needs to be met without requiring expensive and energy intensive renovations.[1]

Conspicuous consumption: A term used to describe the lavish spending on goods and services that are acquired mainly for the purpose of displaying income or wealth. In the mind of a conspicuous consumer, such display serves as a means of attaining or maintaining social status. [2]

Home: The place where a person, family or household lives. While a house or other residential dwelling is often referred to as a home, the concept of "home" is broader than a physical dwelling. Many people think of home in terms of where they grew up or a time rather than a place.[3]

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[1] Wikipedia contributors, "Adaptability," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/ Adaptability (accessed June 2, 2007).
[2] Wikipedia contributors, "Conspicuous consumption," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/Conspicuous_consumption (accessed May 10, 2007).
[3] Wikipedia contributors, "Home," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/Home (accessed May 10, 2007).

House: A dwelling generally refers to a shelter or building that is single family detached dwelling or place for habitation by human beings.[4]

Housing bubble: A rapid increase in the valuations of real property such as housing until unsustainable levels are reached relative to incomes, price-to-rent ratios, and other economic indicators of affordability. This in turn is followed by decreases in home prices that can result in many owners holding negative equity, a mortgage debt higher than the value of the property.[5]

McMansion: A pejorative architectural term which first came into use in the United States during the 1980s as a description of a particular style of housing that is constructed in an assembly line fashion reminiscent of food production at McDonald's fast food restaurants. So-called "McMansions" often have a large footprint, cookie-cutter designs, similar architectural styles, and are often located in a newer, larger subdivision or replace existing, smaller structures in older neighborhoods. They are known as a McMansion because they are not quite mansions and because so many of them look alike.[6]

Prefab (or Modern Prefab): A Prefabricated home with prefabrication as a means to deliver well-designed and mass-produced modern homes in modern architecture, which

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[4] Wikipedia contributors, "House," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/House (accessed May 10, 2007).
[5] Wikipedia contributors, "United States Housing Bubble," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/ United_states_housing_bubble (accessed March 2, 2008).
[6] Wikipedia contributors, "McMansion," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/McMansion (accessed January, 2, 2008).

provides a design with clean lines and more open floor plans rather than features with decoration.[7]

Prefabricated home: A house manufactured off-site in advance, usually in standard components that can be easily shipped and assembled. The prefabricated construction methods include a modular home, a manufactured home, a panelized home and a mobile home.[8]

Speculative House: A house designed on a speculative basis without a buyer, in hopes someone will turn up who will buy it. Also known as a Spec House.

Structural Insulated Panel: A high performance building panel used in floors, walls, and roofs for residential and light commercial buildings. It is made by sandwiching a core of rigid foam plastic insulation between two structural skins of oriented strand board (OSB). Typical foam cores are made of expanded polystyrene (EPS), extruded polystyrene (XPS) or rigid polyurethane foam, however, other materials, such as wheat straw and agricultural fiber for the core, and fiber-cement or plywood for skin, can be used for specific purposes.[9]

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[7] Wikipedia contributors, "Prefabricated home," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/Prefabricated_home (accessed June 2, 2007).
[8] Ibid.
[9] Wikipedia contributors, "Structural insulated panel," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/ Structural insulated panel (accessed June 2, 2007).

Stick-built home: A home constructed entirely or largely on the site which it is intended to occupy upon its completion rather than in a factory or similar facility. This term is used in contrast to mobile homes and modular homes that are assembled in a factory and transported to the site entirely or mostly complete and hence are not "stick-built". Homes that are custom-designed or built according to stock plans are considered stick-built so long as they are constructed on-site.[10]

Sustainable Design: The art of designing physical objects to comply with the principles of economic, social, and ecological sustainability. It ranges from the microcosm of designing small objects for everyday use, through to the macrocosm of designing buildings, cities, and the earth's physical surface. It is a growing trend within the fields of architecture, landscape architecture, engineering, graphic design, industrial design, interior design and fashion design. It is also referred to as "green design" or "eco-design" or "design for environment."[11]

Tract housing: A style of housing development in which multiple identical, or nearly-identical, homes are built to create a community. Tract housing may encompass dozens of square miles of extended areas of land commonly held for subdividing and development into residential units. Tract housing developments are typically found in American suburbs, and are modeled using the "Levittown" concept. Also known as

[10] Wikipedia contributors, "Stick-built," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/Stick-built (accessed June 2, 2007).
[11] Wikipedia contributors, "Sustainable design," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/Sustainable_Design (accessed June 2, 2007).

Cookie-Cutter Houses, a house built on this project is usually designed on a speculative basis: a spec house. The primary motivation for this type of project is its efficiency of design, construction and sales process. These practices reduce the final price of the homes, and allow greater profits for the developers.[12]

Visitability: an international movement to change home construction practices so that virtually all new homes, whether or not designated for residents who currently have mobility impairments, offer three specific accessibility features: 1. At least one zero-step entrance on an accessible route leading from a driveway or public sidewalk, 2. All interior doors providing at least 31 ¾ inches of unobstructed passage space and, 3. At least a half bathroom on the main floor.[13]

[12] Wikipedia contributors, "Tract housing," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/Tract_housing (accessed July 30, 2007).
[13] Wikipedia contributors, "Visitability," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/Visitability (accessed June 2, 2007).

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SECTION A
D. ARCH. PROJECT STATEMENT

A house is a dwelling; a structure used for habitation by people. Its most significant role is sheltering its residences from harsh environments. A house is also a real estate investment which is one of the biggest securities for most Americans. A house should be representative of the people who live in it; a well designed house should reflect the homeowner's taste, characteristics, life style, social status, and financial situation. The best designs reflect who lives in the house and their time spent in the house.

Le Corbusier called the house "a machine for living in," and architect Debora Gans notes "that the house is a tool people control, not the other way round."[14] In researching the recent housing boom, however, I found that one of the most important things for homebuyers, and possibly their major goal, is buying a "large house." The larger the house, the more successful people feel.

Prospective homeowners do care about having a safe and comfortable house for themselves and their family. But when they prioritize their wish list for their dream house it is basically how big of a house can they buy, how large of a mortgage can they get, and what type of house will make them look successful to other people. The fiscal value of the house seems to control the choice of the house. I believe it is time for people to rethink what they are looking for in a "home."

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[14] Cathleen McGuigan, "The Mcmansion Next Door: Why The American House Needs A Makeover," October 24, 2007, Newsweek, http://www.newsweek.com/id/61935/output/print (accessed February 20, 2007).

It appears that homebuyers are encouraged by everyone to buy the biggest house they can get; the bigger, the better. The government promotes the home ownership policy, bankers welcome homeowners to acquire bigger loans, builders are building McMansions everywhere, and realtors are sending us, every week, numerous invitations for the openings of new subdivisions. TV and Magazines are also very influential. Many, who believe it is the American way, accept it as part of social trends.

Since post war, housing developers established their impregnable position in the housing market. They did a good job of working with the government and bankers, analyzing trends, and providing houses that their consumers wanted. These houses have become very glamorous with a lot of fancy gadgets, but are also more expensive. It appears that many Americans welcomed this trend, and without any doubt, they believed this is what they wanted; a big, fancy house; their dream; a McMansion.

Starting around the year 2000, the McMansions became a little more affordable to new homebuyers when the interest mortgage rates decreased. Although the housing prices then increased rapidly along with the demand of the housing market (the US housing bubble), Americans continued to strive for their McMansions. As the price of the houses went up and became harder to buy, the homeowners of the McMansions felt very elite.

Developers and home builders say, “We are building the American dream,” “This is what keeps this country going.” And “homebuyers love it.” Yet, architect, Avi

Friedman, questions the Americans' desire to house themselves so spaciously. "Their wish to live in a scaled-down version of Windsor Castle is intriguing" he says.[15]

He said further, "I wondered if it was an expression of wealth or a craving for higher social status that makes people buy these monster homes. And does easy access to financial credit have something to do with it? Is their house size really the homebuyers' choice, or are they obliged to buy these dwellings because smaller houses aren't available? The average family size of North American households has shrunk in recent years, so why do families still upgrade and buy even larger homes?"[16]

On the other hand, a recent survey by Better Home and Garden magazine revealed that Americans are not completely satisfied with their homes. Many of them had completed or were working on home improvement projects, and they are expecting to expand their project when they could afford it in their budgets. Not only that, but due to expanding their family size, many of them have moved to a different house every 3-5 years. Today American home owners are looking for a more flexible and affordable house.[17] They are not happy with the choices they are given.

In America, the majority of traditional speculative housing is modeled using the "Levittown" concept, the first truly mass-produced suburb,[18] which was developed nearly 60 years ago and the McMansion which became popular in the 1980's.[19]

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[15] Avi Friedman, *Room for Thought: rethinking home and community design* (Toronto: The penguin Group, 2005), 4.
[16] Ibid.
[17] BHG.com, "American Homeowners' Wish List," Better Homes & Gardens magazine, January 11, 2005, http://www.bhg.com/bhg/story.jsp?storyid=/templatedata/bhg/story/data/BHBL_Survey_01112005.xml&catref=cat4180002&psrc=storyrl (accessed June 20, 2007).
[18] Wikipedia contributors, "Levittown, New York," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/Levittown%2C_New_York (accessed April 20, 2007).

In the late 1940s and ’50, many architects proposed and demonstrated the core idea of modernism, the modern house, which through mass production ordinary people could afford the best design. However, it never seemed to catch on. The brilliance of the modern house was in the flexible spaces that flowed from one area to the next, and in the simplicity and toughness of the materials. Postwar America saw a few great experiments, most famously in L.A.'s Case Study Houses. Occasionally, a visionary developer, such as Joseph Eichler in California, used good modern architects to design his subdivisions.[20]

Today they're high-priced collectibles. Modernist houses, custom-designed by architects for an elite clientele, are still built, of course. And, therefore, it just seems very natural that the ordinary consumer would believe that their best choice in competing with the custom-designed homes is a glorious McMansion in a brand new subdivision. They don’t even realize that they have another choice.

“Not all McMansions are ugly and shoddy: though most are a badly proportioned pastiche of different styles, some are built with attention to detail and materials. But, as the epithet McMansion suggests, they're just too big for their lots, for their neighborhoods and for the number of people who actually live in them,” Cathleen McGuigan noted in her article, *The McMansion Next Door: Why The American House Needs A Makeover*.[21]

The housing industry says that *we* want bigger and bigger houses. But is this true? McGuigan reports, “Some people are saying ‘Enough already.’ Sarah Susanka, a Minnesota architect, started a mini-movement with her best-selling 1998 book, ‘The Not

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[19] Wikipedia Contributors, “McMansion.”
[20] McGuigan.
[21] Ibid.

So Big House.'[22] Susanka argues that a good architect understands the importance of human scale."[23]

The eco-conscious people hate big houses also because of the energy cost of heating and cooling all those big empty rooms. And now McMansions are not only the staple of new suburbs but they are overpowering the smaller vintage houses in nearby communities by invading older, leafy neighborhoods, where the developers are tearing down houses and replacing with the McMansions.

"I'm so happy with what I got, I want more." Madonna sang in the film Dick Tracy.[24]

This is also true, but a different understanding may be reached if the homebuyer focuses on their housing needs and expectations. Visiting high-quality, compact houses may influence their views. It may also be possible to convince clients that, by keeping the square footage down, they can end up with a higher quality house.[25]

Today, the technology for prefabricated housing is much more advanced and there are bright possibilities for architects to utilize this technology as a new sustainable designing method. Prefabricated housing will benefit not only architects by providing a bigger opportunity to practice their skills to a wider market, but will also benefit the homeowner who is looking for flexible and affordable housing.

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[22] Sarah Susanka, *The not so big house: A blueprint for the way we really live* (Newtown: Taunton Press, 2001).
[23] McGuigan.
[24] Stephen Sondheim, "More," *Dick Tracy*, (Universal City: Universal Studios, 1990).
[25] Alex Wilson, and Jessica Boehland, "Small is Beautiful: U.S. House Size, Resource Use, and the Environment." *Journal of Industrial Ecology*. Vol. 9 Issue 1-2, Winter-Spring 2005:283. http://mitpress.mit.edu/journals/JIEC/v9n1_2/jiec_9_1-2_277_0.pdf.

New prefab designs, modern prefabricated housing, that use factory-built modules are assembled on-site. The cost could be the same as conventional construction, but it also could be much cheaper and still look great and modern. Joseph Tanney of Resolution: 4 Architecture, which won a Dwell magazine competition to design a cool house in North Carolina for only $80 a square foot,[26] says in McGuigan's article,[27] "We have this concept about design and mass culture in America, with Target, Banana Republic and Design Within Reach."

McGuigan also reports that Seattle architect James Cutler, who designed Bill Gates's Xanadu, is working with Lindal Cedar Homes, a national builder, to adapt a wood-and-glass modernist house for modular construction. "I think there's a return to an interest in modernism," says New York architect Deborah Berke, "and I would call it warm modernism, not sleek minimalism."[28]

This D. Arch. project seeks to propose a housing plan which demonstrates the many possibilities of prefabricated housing. By applying one of the notable prefabrication methods, Structural Install Panel Systems, the construction periods can be extremely shortened, construction wastes can be eliminated, and high R-values are provided to reduce energy costs to the homeowners. Hopefully this project can provide homebuyers with some insight into how living in "a home within reach" is not so bad, and is actually quite amazing and fulfilling, since it is an extremely sustainable and

[26] A custom house would cost $200 to $400 per square foot.
[27] McGuigan.
[28] Ibid.

economical way to design a house. The design will show how the house can expand as the family size grows, and divide as the family size shrinks.

In the early stage of a family, the homeowners require minimum functional space, such as a kitchen, a dining area, a living room, a bathroom and a bedroom. As the family grows, a few bedrooms will need to be added as well as additional bathrooms and possibly a guest room. After the children grow up and leave to go to college or get married, etc., the house will suddenly become an empty nest. That is the time the homeowners will have various options in the use of their space. They could use half of the first floor for office space and start working from their house. They could close off that space and rent it out as a small apartment which would help them to pay their mortgage or their children's college. A third option is for them to purchase a prefabricated staircase, so the house could be converted into a duplex. As the homeowners get older, they could move into half of the first floor unit, where an accessible designed shower room is equipped for the elderly or for those in need of special care. Again they will have the choice to either rent out the main unit for their retirement income source or possibly their children's family can move into the main area.

SECTION B
BACKGROUND AND FIELD STUDY

1. American Dream: Today's American Home

Americans love having a big house with a lot of bedrooms. The move toward larger homes has been accelerating for years. Since 1950, the average size of new single-family houses in the United States has more than doubled, even though the average family size has steadily shrunk.[29] [30] More area (square footage) per family member is being used than ever before, and projections are that the trend will continue.

Twenty percent of occupied homes had, for example, four or more bedrooms in 2005, up from 17.7 percent in 2000. Many states have well exceeded 20 %, such as Utah 39.2%, Maryland 28 %, Colorado 26.2%, and Delaware 25.8%.[31]

In 1950, the average size of a new home built in the United States was only 983 square feet. It increased to 1500 square feet by 1970, 2080 square feet in 1990, 2250 square feet in 2000, and 2,349 square feet by 2004. This represents a 140% increase in size since 1950.[32]

Today everything pertaining to houses seems bigger. In the 1950s and '60s, middle-class homeownership was considered one of the greatest postwar achievements, and tract homes with few amenities were meant to satisfy the basic needs of a young

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[29] Average household size in the United States has dropped steadily from 3.67 members in 1940 to 2.62 in 2002.
[30] The U.S. Census Bureau and the U.S. Department of Housing and Urban Development.
[31] *Navy FCU Home Port,* Vol. 498, No. 1, Winter 2008 (Merrifield: Navy Federal Credit Union, 2008), 2.
[32] National Association of Home Builder, "Housing Facts, Figures and Trend," March 2006.
(Margot Adler, "Behind the Ever-Expanding American Dream House," *Your money*. NPR. July 4, 2006. http://www.npr.org/templates/story/story.php?storyId=5525283 (accessed January 14, 2008).

family.[33] People thought it was normal for a family to have only one bathroom and for two or three growing boys to share a bedroom. It was basically the same for financially well-off people as well, who summered in tiny beach cottages on Cape Cod or off the coast of California.[34]

In 1967, for example, 48% of new single-family houses had garages for two or more cars; by 2002, that figure had jumped to 82%. In 1975, 20% of new single-family houses had 2.5 or more bathrooms; by 2002, that figure had increased to 55%. In 1975, 46% of new houses had central air conditioning; by 2002, 87% had it.[35]

The size of the kitchen alone has doubled to nearly 300 square feet. Ground-floor ceilings have grown by more than a foot; in 2004, 43% of new homes had 9-foot ceilings, up from less than 15% in the 1980s.[36] Bedrooms are now an average of 12 feet by 12 feet, compared to 9 feet by 10 feet 30 years ago.[37]

"Now, many of those cottages have been replaced with bigger houses. Also, six-room apartments in cities like New York or Chicago are being combined together, because upper-middle-class people now think a six-room apartment is too small. Is it wealth? Is it greed? Or are there more subtle things going on?" Margot Adler, a correspondent of NPR(National Public Radio) questions. [38]

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[33] Friedman, 2005, 8.
[34] Margot Adler, "Behind the Ever-Expanding American Dream House," *Your money*. NPR. July 4, 2006. http://www.npr.org/templates/story/story.php?storyId=5525283 (accessed January 14, 2008).
[35] Wilson and Boehl, 278.
[36] Christopher Solomon, "The swelling McMansion backlash," *Real Estate*, MSN, 2008. http://realestate.msn.com/buying/articlenewhome.aspx?cp-documentid=418653 (accessed January 2, 2008).
[37] ABC News, "America's Homes Get Bigger and Better: As the American Family Shrinks, Houses Grow," ABC News Internet Ventures, Dec. 27, 2005. http://abcnews.go.com/GMA/Moms/story?id=1445039&gma=true (accessed January 10, 2008).

[38] Ibid.

And "There's more money around," said Barbara Corcoran, a New York-based real estate agent and "Good Morning America's" real estate correspondent, in ABC News reports. "People are more vested in where they live. The houses that are driving the housing prices and sizes way up are the ego homes."[39]

ABC News reports, that bigger and better seem to be the way to go in housing these days. The percentage of homes costing $1 million has doubled since the 1970s, and the sale of those homes has increased at a rate of 500 percent. Homeowners are gravitating toward super-size windows and doors. Corcoran also added, "A laundry room is the most desired home amenity. People also want walk-in pantries, his and her showers, home offices, and media rooms."[40] Today, those houses, referred to as Trophy Houses, Monster Mansions, Starter Castles, and, the famously known McMansions, are very popular.[41] [42]

James Hughes, a Rutgers University professor and planning expert, said in January 2007 that he started using the term McMansion more than 10 years ago to describe large houses that look alike, with brick-fronts, two-story foyers, ornate exteriors with multiple turned gables instead of straight rooflines.[43]

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[39] ABC News.
[40] Ibid.
[41] McMansion was named because those houses are not quite mansions and because so many of them look alike. McMansion is a pejorative architectural term which first came into use in the United States during the 1980s as a description of a particular style of housing that is constructed in an assembly line fashion reminiscent of food production at McDonald's fast food restaurants. So-called "McMansions" often have a large footprint, cookie-cutter designs, similar architectural styles, and are often located in a newer, larger subdivision or replace existing, smaller structure in older neighborhoods.
[42] Wikipedia Contributors, "McMansion."
[43] Abbott Koloff, "Not every higher-end buyer wants McMansion." *Where We Live*, Part 3, Daily Record. September 30, 2002.
http://www.dailyrecord.com/news/wherewelive/series3 (accessed January 10, 2007).

Now, he said, it's the McMansions which are getting bigger by the year. Hughes said the typical McMansion of 10 years ago had a little more than 3,000 square feet of living space; now they often have 5,000 square feet. Most have two-story foyers, and they all have large family rooms, which developers say have become the center of American life. They often include a home theater, replacing the finished basement. Also, two-story family rooms have become very common. Kitchens are joined to the family rooms so parents have an easier time watching their children. Hallways separate second-floor master bedroom suites, the parents' retreat, from the children's bedrooms. [44]

For all their space and amenities, these homes, at least in today's marketplace, are not considered truly high-end, and have become almost commonplace. And Realtors say they have no trouble selling million-dollar homes. "They want the just-arrived look," and McMansions with their large foyers appeal to people with "new money" who want to make a statement. [45]

In her article, "Behind the Ever-Expanding American Dream House", Margot Adler reports about one of the examples of the McMansion. The house in Fulton, MD., between Washington, D.C., and Baltimore is 11,000 square feet and sits three stories high on three-and-a-half acres. Its amenities include an English garden, a wine cellar, a master bedroom larger than many apartments, a spiral staircase, a music room, a gym, a sauna, a steam room, and a business office. And then there's "the room:" a major entertainment

[44] Ibid
[45] Ibid.

center with a 10-foot-wide screen for movies, top-of-the-line projection equipment, a bar and huge leather lounge chairs.[46]

"I believe that you can live out your fantasy," the homeowner, Michael Frisby, a former White House correspondent for *The Wall Street Journal* said. "That is what I'm doing. That is what my wife is doing. That is what other people are doing when they build or buy a house like this."[47]

Frisby's house is big, but he is not alone. Stephanie McCrummen, Washington Post staff writer, reported an interesting article in November 2005 when the housing market hit its highest number throughout history; …When Alyson Skinner wanted a bigger house on 10 acres in western Prince William County, there it was. For just under a million[…] and with the equity from her smaller home […] she was able to get more space for roughly the same mortgage payment to accommodate the lifestyle she envisioned for her family. Instead of going out into the world, she preferred to contain the world inside her 5,300-square-foot home. [48]

"We have a media room in the basement, a pool table and a moon bounce, so I don't have to take the kids out and fight traffic," said Skinner, 32, a former art director who lives there with her husband; their two children; and, at times, family and friends who come on weekends. "We enjoy it more when the kids come here and play. Specifically, I'm weird, but I'm supersensitive to the kids getting snatched. Like at Chuck

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[46] Adler.
[47] Ibid.
[48] Stephanie McCrummen. "Taste for Space Is Spawning Mansions Fit for a Commoner: Hot Housing Market Opens Doors to Mini-Taj Mahals." *Washington Post*. November 20, 2005. http://www.washingtonpost.com/wp-dyn/content/article/2005/11/19/AR2005111901445.html (accessed February 20, 2007).

E. Cheese, I have to constantly watch them." "Next, I want a huge laundry, a mudroom, an activity room with linoleum floors so if the kids spill the paint, it won't matter," she said. She wants a pool house with a bathroom, and another garage for the mower, the Barbie Jeep and the giant Slip'n Slide. "Me and my friends joke about this, but I think Pottery Barn is responsible," Skinner said. "You get the catalogue showing playrooms, then there's a craft room, and you're like, 'Yeah, I need a craft room.' " [49]

For Donna Sproles, the quest for more meant not only more "house", but also more land. She and her husband have their 6,000 square feet on 10 acres, which, in her view, provides a little more freedom and independence. "What I love about this is it's so big that we can go into different areas of the house and have private time, if you will," she said, sitting in the family room of her $800,000 home with her two sons. "If Jonathan wants to play, he's in his area. If Justin wants to go online, he's in his room and he can do that. If someone wants to come in here and watch TV, that's their space," and if she and her husband want to watch TV, they have their own private sitting room, far enough away that the two do not interfere.[50]

Her husband, Jeff, who travels constantly and works 14-hour days, said: "Am I happier having space? Absolutely…I don't worry as much. If my kid wants to hit a golf ball, I don't have to worry about it clocking a BMW." And yet, Donna Sproles said, now that she has lived in the house awhile, it doesn't seem so big. "You get used to it," she said. "And then, you drive down the road …" [51]

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[49] Ibid.
[50] Ibid.
[51] Ibid.

2. McMansion Phenomenon

For over the past half-century housing developers have expanded on the notion of tract and speculative housing throughout the United States. They have gradually replaced the form, materials, and layouts that originated in local traditional housing from the designer's birthplace with more look-a-like and commonly recognizable features.

In architecture, design responds to existing conditions. Those constrains may be functional or a composite of monetary and jurisdictional encumbrances, such as building codes and zoning ordinances. The design of a building must resolve those constraints. Today, however, vernacular and local styles have especially started to erode and fade, the only exception being regional design variations resulting from climatic differences.

Changes in production and distribution of building products have majorly contributed to homogeneity. Doors, windows, exterior cladding, and roofing products are now manufactured by multinational corporations that market identical items nationally and internationally. Even at the product level, then, regionalism is rapidly diminishing. And they also seem to encourage incorrect elements of housing designs.

The most common element of the exterior of the McMansion is, for example, a masonry veneer facade located on the front side of the house, with the other sides being covered with a less expensive material, often vinyl siding. It is reasonable to support, this is done to give the impression to outsiders that the house is a "quality" house built of brick. [52]

[52] Wikipedia Contributors, "McMansion."

And one of the common aesthetic complaints is that McMansions are overly ostentatious; for example, the front façade may boast multiple gables in addition to blind dormers, porticos, and a staggered garage that has been placed forward from the body of the house, facing the street. Builders add dormers and other decorative roof features that are intended to appear as multiple roof lines and thus avoid multiple roof lines which are too costly.[53]

Other aesthetic issues could encompass traditionally functional elements, like shutters, now used as a non-functional ornament, or more generally a poor choice of ornamental elements for that particular construction and site. Lack of mature trees and recently planted trees is another obvious feature of new subdivisions. In many instances it is less expensive for a developer to clear cut the entire subdivision and plant immature trees in strategic locations, even though mature trees generally provide reduced cooling costs in summer months by providing shade to the home. However, keeping these mature trees in place would require the developer to expend more capital when sitting the location of each house on each lot.[54] Also, a lot of people think that the young trees give the house a fresh and clean impression.

Those movements are definitely cost effective. And they meet the demand for a lot of people who are looking to find a bigger house for a minimal amount of money. Along with the increased size of homes and added fancy features, however, has come the cookie-cutter facade area which allocated, in many cases, at least 40 percent of the front elevation to the garage door in many cases, causing the homes to lose their grace. Little

[53] Ibid.
[54] Ibid.

area is left for anything else. Placing an entrance door in the middle of a home or installing a picture window in the living room to let in more light is hard to do once a two- or three-car garage occupies a sizable chunk of the front wall. [55]

Styles are often altered in order to make a house look more spacious than it really is. Unlike Architects of custom-designed houses who offer a choice of different facades-from modest to ostentatious-to reflect the homeowner's personality, for the most part homebuyers are given, at best, the choice of a shade of brick or of garage door color; they tend to have very little say in the matter and are at the mercy of the developer.[56]

In residential design and construction, those "problems" may be a result of the introduction of "production housing" which started in the 1950s in Levittown, New York. For our purpose, the most significant aspect of this occurrence was that single-family housing is based on a mass-market philosophy.

Then why do people keep buying those Trophy Houses and McMansions? Are they not given enough choices or enough designs? Do those choices and designs given to them for the biggest purchase in their lives, reflect their personality? Is it just because the home buyer can financially afford to buy a bigger house? Then why are houses getting bigger and bigger? And why do people love big houses?

3. Motivation behind McMansion

A. Obtaining the American Dream

[55] Ibid.
[56] Friedman, 2005, 17-18.

It is a well known fact, that owning a house, especially a big house, is the "American Dream." In American history, many of the first settlers of the United States came from highly populated urban settings in European countries. The poverty-stricken newcomers who crossed oceans hadn't owned land or homes in their native countries. North America wasn't only the land of opportunity, but a vast place where land was plentiful and cheap. At first, new arrivals lived in crowded cities along the Atlantic coast. But many dared to migrate into the hinterland and settle it, developing what later became known as the frontier mentality. Along with land ownership, came homeownership. Houses built in rural areas had no size restrictions or zoning limits; their size was mostly governed by how much the owner could afford to spend. This mindset has not subsided; immigrants are still drawn to this continent by the opportunities the place offers, chiefly homeownership. A home of one's own is, after all, the core of the American Dream.[57] But perhaps the most compelling explanation of the size of houses, which have become larger and larger, lies in the evolution of homeownership.

B. **Homeownership Policy**

During the last Presidential election campaign in 2004, President George W. Bush boasted that "the overall U.S. homeownership rate in the second quarter of 2004 was at an all time high of 69.2 percent." Bush's 2004 campaign slogan "the ownership

[57] Friedman, 2005, 5.

society" indicates the strong preference and societal influence of Americans to own the house they live in, as opposed to renting.[58]

Throughout the history of homeownership in the United States, there have been strong political engagements with each period of economical policies. Before the devastation of the Great Depression, governments believed that housing was essentially the responsibility of the free market.

However, during the Great Depression, the banking system failed, causing a drastic decrease in home loans and ownership. At this time, most home mortgages were three to five years' short -term, no amortization, and balloon instruments at loan-to-value ratios below fifty to sixty percent. The banking crisis of the 1930's forced all lenders to retrieve due mortgages. Refinancing was not available, and many borrowers, now unemployed, were unable to make mortgage payments. Consequently, many homes were foreclosed, causing the housing market to plummet. Banks collected the loan collateral, foreclosed homes, but the low property values resulted in a relative lack of assets. Because there was little faith in the backing of the U.S. government, few loans were issued and few new homes were purchased.

In 1933 under President Franklin Roosevelt, the Home Owners' Loan Corporation, known as HOLC, or Home Owner's Refinancing Act, was established. Its purpose was to refinance homes to prevent foreclosure. It was usually used to extend loans from shorter, expensive payments of 15 year loans to lower payments of 30 year loans. Through its

[58] Wikipedia contributors, "United States Housing Bubble."

work it granted long term mortgages to over a million people facing the loss of their homes.[59]

In 1934, the federal banking system was restructured. The National Housing Act of 1934 was passed and the Federal Housing Administration was created. Its intent was to regulate the rate of interest and the terms of mortgages that it insured. These new lending practices increased the number of people who could afford a down payment on a house and monthly debt service payments on a mortgage, thereby also increasing the size of the market for single-family homes.[60] [61] Thus homeownership was opened up to the working class, and soon the suburban family with a new house and a long-term FHA debt became the symbol of the American way. Largely through FHA programs, equity was introduced to the estates of thirty-five million households between 1933 and 1978. [62]

According to Kenneth Jackson, the FHA's conservative policies strongly favored single-family over multi-family dwellings and new construction over rehabilitation of existing units.[63] [64] Rampant consumerism following World War II, coupled with the

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[59] Wikipedia contributors, "Home Owners' Loan Corporation." Wikipedia, The Free Encyclopedia. http://en.wikipedia.org/wiki/Home_Owners'_Loan_Corporation (Accessed June 18, 2007).
[60] Wikipedia contributors. "Federal Housing Administration." Wikipedia, The Free Encyclopedia. http://en.wikipedia.org/wiki/Federal_Housing_Administration (Accessed June 18, 2007).
[61] Alexander Garvin, *The American City: What Works, What Doesn't*. 2 edt.. (New York: McGraw-Hill, 2002).
[62] Friedman, 2005, 7.
[63] According to Kenneth Jackson, "Data on the geography of actual FHA loans was mostly kept secret, but when data has been released, scholars have found that FHA's generous programs were targeted disproportionately and almost exclusively to white Americans building homes in suburbs. Between 1935 and 1939, 220 out of 241 loans in St. Louis (91%) were located in the suburbs. From 1934 to 1960, the county of St. Louis received five times more FHA loans than the city of St. Louis, despite greater economic need in the city. Similarly, the average resident of Bronx County New York received just $10 in home mortgage loans from the FHA during its first 25 years, while the average resident in the wealthy Nassau County received $601." Wikipedia contributors, "Federal Housing Administration." Kenneth Jackson, *Crabgrass Frontier: The Suburbanization of the United States*. (Oxford: Oxford University Press. 1985.) Chapter 11.

great number of returning GIs and the baby boom that followed closely thereafter, created a terrific housing demand. This demand was reinforced by the United States government's official support of the view that sixteen million GIs should return to civilian life with a home of their own. [65]

At the end of World War II, the 1945 amendment to the Servicemen's Readjustment Act of 1944 was created. Commonly known as the "G.I. Bill of Rights", it provided that an honorably discharged veteran of World War II was eligible for a G.I. loan guaranteed by the government for the purpose of buying a home, and any remaining balance could be financed through a mortgage loan with any recognized lending agency.[66] Thousands of veterans were vitally interested in building and owning their own homes and the G.I. Bill bolstered the demand for owner-occupied units by enabling veterans to borrow the entire appraised value of a house.

The most conservative of FHA estimates indicated that responding to this demand would immediately require the construction of five million new units, with a total of 12.5 million over the following decade. Traditional approaches to housing developments by the numerous small-scale builders with their teams of specialized laborers would be insufficient for the task. The need for change was clear. [67]

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[64] According to the U.S. Department of Housing and Urban Development, by 2001, The FHA and HUD have insured over 34 million home mortgages and 47,205 multifamily project mortgages since 1934. FHA currently has 4.8 million insured single family mortgages and 13,000 insured multifamily projects in its portfolio.
[65] Friedman, 2005, 7-8.
[66] Antique Home Company, "G.I. Bill of Rights on Home Loans: For every vet who wanted one, a home loan was available," Refer to *The House-of-the-Month Plan Book for 1946*. http://www.antiquehome.org/Library/G-I-Bill.htm (accessed July 14, 2007).
[67] Friedman, 2005, 6.

Governments responded with assurances and financing programs that would make it profitable for private developers to build mass-produced subdivisions on vast tracts of land. The banking industry, as a result, began to play a critical role in home building. Since the amount of money that people were willing and able to pay month after month was integral to the type of house they'd buy, a multitude of design strategies were all aimed at obtaining that magic number. Surprisingly, some of these strategies-such as smaller homes on small lots and with unfinished parts-went against the grain of conventional financial wisdom. Bankers preferred homebuyers who could commit themselves to a large loan, as long as it was paid back. Potential buyers were, in fact, encouraged to borrow. [68]

When the modern mortgage system was set up in the years following the Second World War, regulators allowed 25 percent of a combined household income to be allocated for shelter expenses (mortgage payments, municipal taxes, and utilities). It was assumed that the remaining 75 percent would be spent on other basic household expenses such as food, education, and retirement. The 1950s saw a large number of first-time homebuyers lining up outside model homes across North America. As the husband was usually the only breadwinner in the family, the 25 percent for shelter would come from his income. [69]

The 1970s saw the return of many women to the labor force, and most families now had two pay checks. Financial regulators recognized this trend, and upped the allowable shelter allocation to 32 percent of the now-enlarged total household income. In

[68] Ibid.
[69] Friedman, 2005, 7.

real terms, homebuyers were allowed to spend much more on housing. Builders did not miss this opportunity. They knew that a higher disposable income meant being able to spend more on a home. [70]

Local government welcomed this trend. Houses have become the main source of the suburbs' municipal revenue. Taxation is based on property evaluation, of which size is the determining factor. Owners of small homes, then, pay less than owners of large ones yet use the same municipal services. Unsurprisingly, developments with typical lots measuring a whopping 60 by 100 feet have become the norm in suburbia. When a request was placed before a city council for a permit to build higher-density developments made up of smaller, lower-cost homes, it was not preferred. [71]

The regulations of mortgage lenders also play a part in the bloating of America's houses. In some affluent areas, lenders require a fixed ratio between the cost of the land and the cost of the house. If the land is expensive, then the house must be expensive, too.[72]

C. Investment

Although, the investment motive for purchasing homes should not be conflated with the necessity of shelter that housing provides; a house many times plays an important role in our financial security. Among Americans, home ownership in many

[70] Friedman, 2005, 8.
[71] Friedman, 2005, 9.
[72] James Gauer, *The new American dream; living well in small homes*. (New York: the Monacelli Press, Inc., 2004), 11.

cases is widely accepted as preferable to renting, especially when the ownership term is expected to be at least five years.[73] [74]

Over the past years, the purchasing of a home as an investment has gradually became popular. When considering a house as an investment, that is, as an asset that is expected to grow in value over time as opposed to the utility use of shelter that home ownership provides, it is good to remember that housing is not a risk-free investment.

The popular notion that, however, unlike stocks, homes do not fall in value is believed to have contributed to those enthusiastic but ordinary investors for purchasing homes. This assertion that property prices rise has been true for the United States as a whole since the Great Depression, and appears to be encouraged by the real estate industry. [75] Compounding the popular expectation that home prices do not fall, it is also widely believed that home values will yield average or better-than-average returns as investments. [76]

The Board of Governors of the Federal Reserve System state in their research, "Like other asset prices, house prices are influenced by interest rates, […,] the housing market is a key channel of monetary policy transmission."[77] And when the Federal Reserve cut short-term interest rates to historically low levels, from about 6.5% to just 1%, it logically resulted in an increase in prices in a market where most people borrow

[73] This is partly due to the fact that the fraction of a fixed-rate mortgage used to pay down the principal builds equity for the homeowner over time, while the interest portion of the loan payments qualifies for a tax break, whereas, except for the personal tax deduction often available to renters but not to homeowners, money spent on rent does neither.
[74] Wikipedia contributors, "US housing Bubble."
[75] "I want my bubble back", Motley Fool, 2006-06-09. (Wikipedia contributors, "US housing Bubble.")
[76] Wikipedia contributors, "US housing Bubble."
[77] International Finance Discussion Papers, Number 841, House Prices and Monetary Policy: A Cross-Country Study", Federal Reserve Board, September 2005.

money to purchase a home. With the shortage of housing in areas, especially, California, Florida, New York, the Northeast megalopolis, and the southwest markets, the demands for new housing was extremely high for both homebuyers and homebuyers as investors.[78]

Because a drop in mortgage interest rates reduces the cost of borrowing, even though homeowners decided to move up to a larger and more expensive house, the monthly payment of the mortgage could remain the same as the smaller house or even the cost of apartment rent. Again, the demand of the housing market is rising high, and the housing prices are going up. In some popular regions between 2004 and 2005, record price increases were astonishing in excess of 25% per year. [79]

Eventually, the housing prices will get so high they reach the point where buying a house as an investment does not make sense any more. For example, Andrew Laperriere, a reporter from Weekly Standard, reports on a townhouse in Fairlington, a venerable apartment and townhouse community in the Virginia suburbs. A typical three bedroom townhouse in Fairlington recently sold for $575,000. Assuming the owner put 10 percent down and took out a traditional 30-year fixed-rate mortgage, the monthly payment would be just under $3,200. Add in property taxes, a condo fee, and the tax breaks for home ownership, and the cost of owning this unit comes to about $3,000 a month.[80] Yet the very same place rents for no more than $1,700 a month, or just over half the cost of ownership. Why own it? One powerful reason must be an expected profit down the road. People are buying in the face of sky-high prices because they've seen so

[78] Wikipedia contributors, "US housing Bubble."
[79] Ibid.
[80] Note: this analysis takes into account the lower cost of owning due to low interest rates and ignores the $57,500 down payment

many of their friends or relatives make a fortune in real estate; besides (they tell themselves), everyone knows real estate prices never fall. [81]

And Bonnie Bennett, a loan officer, and her husband, a computer salesman, who think they are relatively average people, are among those people who believe in the speculative strength of real estate investment. They found a big house, a McMansion, with a three-car garage, a media room, a solaria and a conservatory. In the Washington region, average incomes are among the highest in the nation. Low interest rates, 100 percent financing, and the money that people can make from selling their homes in a booming market have made buying a larger one affordable for more people, whose appetite for space, builders say, seems insatiable. The Bennetts' reasons for moving to this big house with their two children were clear: They wanted to invest the largest amount from their townhouse, which had skyrocketed in value, and thus bought the biggest house they could afford. "It was almost ridiculous not to do it," Bennett said, adding that even if she never exactly wanted 8,000 square feet, she sure loves having it now. [82]

Many experts blame the US real estate bubble in 2004 and 2005 on investor speculation and the "irrational" flipping[83] of housing as investments products. Very low interest rates were a root cause, but speculation and flipping compounded the bubble.

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[81] Laperriere, Andrew. "Housing Bubble Trouble: Have we been living beyond our means?." *The Weekly Standard*. April 10, 2006, Volume 011, Issue 28 News Corporation. http://www.weeklystandard.com/Utilities/printer_preview.asp?idArticle=12053&R=13A78371DD (accessed February 20, 2007).

[82] McCrummen

[83] Flipping is a term, used primarily in the United States, which refers to the practice of buying an asset and quickly reselling "flipping" it for profit. Profits from flipping real estate come from either buying low and selling high in a rapidly-rising market, or buying a house that needs repair and fixing it up.

Although the practice of flipping existed long before the real estate bubble, it became more rampant and widespread in those years. Flipping was so popular nationally that detailing the process was shown on many television programs such as HGTV's "House Hunters", "What You Get for the Money", "Designed to Sell", "Buy Me", BBC American's "Location, Location, Location", Discovery Home Channel's 'Double Agents', and TLC's "Property Ladder" and "Flip That House"…and so on. The list seems endless.

In addition to the numerous television shows, book stores in cities throughout the United States could be seen showing large displays of books touting real-estate investment, such as National Association of Realtors chief economist David Lereah's book, *Are You Missing the Real Estate Boom?: Why Home Values* (2005) and *Why the Real Estate Boom Will Not Bust - And How You Can Profit from It* (2007).

D. Greed or Context?

The basic functions of a house are providing "a roof over one's head" and providing security and safety or of serving as a family "hearth and home," and from the days of the pioneers, Americans have pursued its ownership. However, now a house not only provides a place to live, it has become a symbol of the homeowners' social status and has ruled as a display-case for wealth and/or fashion: "conspicuous consumption."[84] Conspicuous consumption is a term Thorstein Veblen, Norwegian-American economist and sociologist, used to depict the behavioral characteristic of the nouveau riche, a new

[84] The term conspicuous consumption was introduced by Thorstein Veblen in 1899 his book: *Theory of the Leisure Class: An Economic Study in the Evolution of Institutions* (New York: Macmillan, 1899), 400.

class that emerged in the 19th century capitalistic society as a result of the accumulation of wealth during the Second Industrial Revolution. [85] Ironically two centuries later, the principle of human nature has not changed much.

And many of us agree that the McMansion is considered a typical example of today's conspicuous consumption. The houses are bought on the principle of paying the lowest dollar-per-square foot price in order to "get more house for the money," or that the sizes of the houses display the owners' wealth and social status.[86]

James Hughes said they are symbols of American culture — a monument to conspicuous consumption in a society where baby boomers have more money than ever to spend. "After World War II, the 900-square-foot Cape Cod, with a picture window and where people could have barbecues in the backyard, was the status symbol of the era," said Hughes, dean of the School of Planning and Public Policy at Rutgers.[87]

If the postwar house provided a shelter, today's home is a gateway to social status. Cindy Gray, one of the McMansion owners said she didn't quite understand why things were getting so big. "I don't know what it is about that," she said, standing in the foyer of

[85] Conspicuous consumption is a term used to describe the lavish spending on goods and services that are acquired mainly for the purpose of displaying income or wealth. In the mind of a conspicuous consumer, such display serves as a means of attaining or maintaining social status. With significant improvement of living standards and the emergence of the middle class in the 20th century, the term conspicuous consumption is now broadly applied to individuals and households with expendable incomes whose consumption patterns are prompted by status seeking rather than their substantial needs and are thereby socially wasteful. In recent years, conspicuous consumption has also been viewed as a contributing factor to behavioral disorders such as compulsive spending and is a major contributor to personal bankruptcies resulting from abuse and mismanagement of credit. (Wikipedia contributors, "Conspicuous consumption."
[86] Wikipedia contributors, "McMansion."
[87] Koloff

her 6,000-square-foot home while her son ran laps in the formal living room. "I don't know if it's just a society thing? But over time, you just get used to it." [88]

Robert Frank, a professor of management and economics at Cornell University, explains that the growth of big houses is not really about greed. It's all about context. "If you live in a village in Africa, even a modest American house seems huge. But in the United States, there are now millions of people with lots of money, and their wealth shifts the frame of reference for those just below them." [89]

Frank continues, "So let's say you want to find the best school district for your child, but the houses there are huge and expensive. You might take fewer vacations, or endure a much longer commute, or save less, but you don't forgo the bigger house, because it means a better neighborhood and a better education. This is a deeper phenomenon, Frank says, than keeping up with the Joneses. "This is about what we feel we need as a function of the context in which we live," he says. "We know that when everyone stands up, no one gets a better view. We know there are all sorts of situations where individual choices that are perfectly rational add up to a total outcome that none of us likes very much. This is one of those." [90]

Another reason which we cannot dismiss when discussing why our homes are getting bigger and we feel we need more space is that we have accumulated many possessions. Our homes have become bloated containers for consumer goods that are big and numerous: oversized furniture and kitchen appliances, multiple big screen TVs,

[88] McCrummen
[89] Adler
[90] Adler

athletic equipment for every sport, decorations for every seasons and occasions, more toys than any child could use or want, and enough clothing to overflow all those coveted walk-in closets.

James Gauer says, "We want our homes big enough to contain the trappings of affluence. And yet, these rarely provide the foundation for a gracious life. Home is as much a symbol as a shelter. American culture encourages hard work and rewards it with material riches. These riches are the outward signs that validate the scope and success of our ambitions. Big houses are symbols of big aspirations and big achievements. And yet the good life they symbolize isn't necessarily what they deliver. They often lack the human scale, refinement, and architectural distinction that could facilitate, if not a good life, at least a comfortable and well-ordered life."[91]

It is true, many of us in America have fallen into the trap of consumption. We buy more and more "stuff" in the pursuit of happiness. But we are never satisfied, because *real* satisfaction doesn't come from a bunch of stuff, no matter how nice it is. And the one thing we really wanted to keep has to be unloaded to pay the bills. We continue to spend, and stuff our houses with needless things that provide fleeting happiness. Our homes -- and our lives -- suffer.

"Have nothing in your house that you do not know to be useful or believe to be beautiful."

[91] Gauer, 13.

The words were given by William Morris[92], a British designer, dreamer, and founder of the Arts and Crafts movement almost 150 years ago. He had lived in an era of Victorian excesses, just as we live in an age of materialism. While the challenges Morris faced were tacky clutter and overdone design, the challenges we face result in tacky clutter, an overabundance of stuff, and insidious credit card and large mortgage debt.

How did we end up to the point where we are now, where we feel the McMansion is the context of our life and we feel that we have to buy bigger houses so that we can buy more stuff? Is it because of our greed?

E. Builder's Strategy

The trend has been toward larger homes, often on smaller lots, with developers tearing down Cape Cod and ranch-style homes to build McMansions. "We build what sells", Developers say, "people were less interested in style and more interested in square footage," "We gave the people what they wanted." Several developers said many people are spending more time at home, either telecommuting or watching a movie with their families in a home theater. They are looking for big homes as a reward for working hard. Again, they said developers are simply giving people what they want.[93]

Although figures from the National Association of Home Builders, a trade group, suggest that after 50 years, the average square footage of U.S. homes may be leveling off, some of the nation's production home builders, including Toll Brothers, say that their

[92] Wikipedia contributors, "William Morris," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/William_Morris (accessed January 10, 2008).
[93] Koloff.

biggest models are only getting bigger.[94] The housing industry emphasizes again, homebuyers want bigger and bigger houses and they are only meeting their demands.

However, many experts argue, "It has been suggested that the popularity of the McMansion may not be purely based on consumer desires." Cathleen McGuigan reports, "Last year's annual report [as of Oct 24, 2007] for Pulte Homes, one of the nation's biggest builders, contains an astonishing fact: if you adjust for inflation, houses of the same size and comparable features are the same price today as they were in the 1970s." She argues, "That means that if business is going to grow, the industry has to sell more products-not just more houses but more square footage. It's like the junk-food-marketing genius who figured out that people wouldn't go back for seconds but they'd pay more upfront to get, say, the 32-ounce Big Gulp..."[95]

Her report continues, "This year, Pulte predicts, the number of houses built will be only slightly higher than last year's.… but houses [...] will continue to get bigger and better, ensuring that real inflation-adjusted spending on residential construction will continue to rise in order to increase profit margins over previous years." Therefore, builders need to build more expensive houses (more features and square footage) on the same tracts.[96]

And other developers agree with it. They admit they are building large homes because it doesn't pay to build small homes when land is so expensive. The average size of new homes increased nationally by nearly 17 percent between 1987 and 1999,

[94] McCrummen.
[95] McGuigan.
[96] McGuigan.

according to the National Home Builders Association, while the average lot size decreased by close to 27 percent. Developers say building those kinds of homes is good business. James Hughes, among others, sees it as capitalizing on some Americans' tendency to show off their wealth.[97] So, in effect, those bigger McMansion houses are not only built and sold by the housing market's demand, but are part of the business strategies used by builders and developers.

Then how can they sell what a new homeowner does not really need? Even though homebuyers might not request the McMansions, are they still excited and happier with a big house?

Eckhart Tolle, a contemporary teacher and an author, explains the consumer's mind. "The people in the advertising industry know very well that in order to sell things that people don't really need, they must convince them that those things will add something to how they see themselves or are seen by others; in other words, add something to their sense of self. They do this, for example, by telling you that you will stand out from the crowd by using the products and so by implication you become more fulfilled yourself. Or they may create an association in your mind between the product and a famous person, or a youthful, attractive, or happy-looking person […]

The unspoken assumption is that by buying this product, through some magical act of appropriation, you become like them, or rather a surface image of them. And so, in many cases you are not buying a product, but an 'identity enhancer.' Designer labels are primarily collective and identities that you buy into. They are expensive and therefore

[97] Koloff

'exclusive.' If everybody could buy them, they would loose their psychological value and all you would be left with would be their material value, which likely amounts to a fraction of what you paid […] Paradoxically, what keeps the so-called consumer society going is the fact that trying to find yourself through things doesn't work: the ego satisfaction is short-lived and so you keep looking for more, keep buying, keep consuming."[98]

When I read this section of Tolle's book, I realized that every mystery of the McMansion was solved. It immediately reminded me of the words by Michel Frisby, a home owner of a McMansion. "I believe that you can live out your fantasy," he said "That is what I'm doing. That is what my wife is doing. That is what other people are doing when they build or buy a house like this."[99] It just all makes sense; why people love McMansions, why people want to own, and why people keep buying them even if it costs them a lot more than they are really worth.

"A lot of people are looking to see how much house they can buy per square foot." And "I'm big on everyone having their own space to be their own individual," Donna Sproles said. "I think everyone needs to express themselves." She explains that she grew up poor in West Virginia, with an outhouse and no running water at times, and made a decision early on that she would never live like that again. "I wanted to become an executive of some sort," said Sproles, who did become a successful computer salesperson. "I wanted to have a cell phone and all that came with it. My vision was to

[98] Eckhart Tolle, *A New Earth: Awakening to Your Life's Purpose* (New York: Penguin Group, 2008), 35-36.
[99] Adler.

have a big house, drive a big car. . . . I don't know where I got it from -- probably TV. I guess that's where I got it. Maybe 'Dallas.' "[100]

A builder Alex Hannigan in Orlando, FL, really understands what Frisby was saying. He proudly presents his latest 9,506 square feet house, which he calls "an all-about-me home." "It has a guest wing, five fireplaces, three laundries, a hobby room, an elevator, a spa, a home theater, a summer kitchen, and a chandelier lift -- not things that the average American can necessarily afford at the moment," Hannigan said. But, he added, "we figured we'd make this home in keeping with where our country's going."[101]

This phenomenon can be attributed in part to the proliferation of Medias; television shows, magazines, and newspaper articles. Reality TV has, for instance" introduced viewers to the living rooms, bedrooms, and bathrooms of both wealthy and celebrity's homes, and have become entertainment, crossing another threshold in promoting consumption of space and content. Homebuyers now are able to take a peek at what kind of houses the wealthy live in. And by so doing, want to own larger houses with good amenities (obviously not the same, but something that they feel is similar on a smaller scale) to enhance their feeling of satisfaction with their identity and success.

Not every McMansion offers features like "an all-about-me home." However, builders strategically offer numerous features that generate larger, glamorous, and more desirable impressions of their products. For example, builders tend to incorporate architectural elements from non-native historical styles to the exterior styles, such as classical and neoclassical architecture, or the half-timbered European styles, particularly

[100] McCrummen.
[101] Ibid.

English, Tudorbethan, Jacobethan, and French chateau styles. They are considered, at least by builders and by the majority of McMansion owners, more elegant and graceful, and give a house the look of a scaled-down version of a European castle or mansion.[102]

The naming of streets and the subdivision itself are a major part of a developer's marketing strategy as well. A common practice is to employ references to Europe, particularly place names and the British peerage system, to convey an upscale, exclusive atmosphere. These neighborhoods tend to have names like "Coventry", "Barrington" "Manorcliff" or "Knightsgate." Italian and Mediterranean names have become en vogue recently, likely due to the increased popularity of Mediterranean architectural styles in America. Developers often build entire neighborhoods of practically identical stucco-and-tile edifices, and cement the theme by christening the developments "Siena", "Terra Bella" and other appellations that intend to invoke an exotic charm.[103]

Regional variations occur on these themes. In the South, many developers attempt to create an upscale atmosphere through references to the plantation lifestyle of the antebellum South, e.g. "Plantation Creek", "Belle Terrace", "Oakhurst" or something similar. Additionally, the home models themselves are given upscale names that may refer to a type of architecture found in well known places such as Dorchester, Avalon, Monticello, Panola, Ashford, etc.[104]

The houses are then decorated to present at a glance, the maximum appeal and best impression to potential homebuyers. This is called the "Ten Minute House" theory,

[102] Wikipedia contributors, "McMansion."
[103] Ibid.
[104] Ibid.

also known as the "atrium concept" and espoused by real estate developers, realtors, and home builders. Consequently, houses change owners more frequently and thus must be designed to be marketable and appealing to as many people as possible, with less emphasis placed on the specific needs of the house's initial buyer. Because most realtors agree that a client will like or dislike a house within ten minutes of entering, combining a home's foyer with a two-story "great-room" leaves secondary rooms more visible, making it easier for agents to show the house—and hopefully win the client over—in ten minutes or less.[105]

Avi Friedman agrees, "Builders have to sell and build quickly and move on to the next project; handing over the keys is their ultimate goal… therefore…A model home-the showcase of a new development, like a new model in a car dealership-must look good. It ought to draw a 'wow,' make an unsure buyer fall in love at first sight, edge out the competition across the street. A hotel-sized kitchen, beautifully lit with stainless steel appliances, will be an anchor; a spacious marble-tiled bathroom with trendy fixtures and a Jacuzzi will be an attention grabber. It's all a question of first impressions."[106]

4. Super-sized Housing Problems

Over the past 50 years, houses have tended to keep growing in size. During the 80's to 90's, builders not only continued to build larger houses, they started to add fancy features to their products such as huge foyers, high ceilings, tall windows, curving staircases, and fireplaces. Houses have become a symbol of a family's social status and,

[105] Ibid.
[106] Friedman, 2005, 23.

therefore, people are willing to spend more money on home luxuries that they don't really need. Homebuyers often have preconceived notions of how large a house they need, often because a friend's house of that size seems to have the features that the client wants.[107] Convincing a new homebuyer to down size can be challenging.

Friedman agrees "The demand for large homes has not, and likely will not, subside; people will continue to spend more time at home and more money on comfort. Designers, appliance manufacturers, and builders will be hard at work searching for modes and means to draw homebuyers to model homes, where they'll be less likely to ask themselves if they really need it"[108].

At the same time, even though many of the "McMansion" owners seem pleased with what they have, some of them have started to recognize the fact that living capaciously has its drawbacks as well. Some owners complain, "It can take an entire weekend to clean the house. Electric and heating bills are often higher than people expect. And simply furnishing the place can be a never-ending task."

George and Georgia Psihas, for instance, have lived in their new, 6,500-square-foot house for three years without furnishing their dining room and living room. With Thanksgiving approaching, the rooms were empty last week except for an upright piano and a vacuum cleaner. She and her husband, who have four children, run a home-improvement business out of their home office, the one room that is used seven days a week. "We simply have not had time," she said, "We moved up . . .,"Georgia Psihas said between answering the door and the phone, as if moving up were just one more item on a

[107] Wilson and Boehland, P.283.
[108] Friedman, 2005, 11.

list of things she had to accomplish. “You know, bigger, better, best, but I don't know necessarily if bigger is better. I don't know if I enjoy it more. The only room I ever sit in is the office. Then I go to sleep in my bed. I don't even know what my bedroom looks like.” As the Psihases saw it, moving into a bigger house was not something to be questioned, but something to be accepted, an axiom of American life. “Bigger bigger, better better,” Georgia Psihas said. “It's just a part of life.” [109]

As in many large houses, some of Alyson Skinner’s rooms are still empty also, while other rooms have essentially become playrooms: The windowed conservatory is an empire of pink toys for her daughter. And on a recent weekday, the family room was strewed with plastic shapes in primary colors. “Mommy!” said a small voice from somewhere. Skinner, sitting at the 10-foot granite kitchen island, looked up. "Where are you?,” she called to her daughter. It is difficult, she said, to make the house feel cozy. And yet, having lived there a while, Skinner has begun to imagine rooms she'd like to add. “The irony is, the bigger the house, the more junk you buy. Then you have nowhere to put it, so you want more storage.” Skinner said [110]

And, in the two years since the Bennett family moved into their voluminous 8,000-square-footer on the edge of Virginia's suburbs, they have not once used their formal dining room, where the table is eternally set for eight with crystal, an empty tea set and two unlighted candles. Not even guests use the palmy, bamboo morning room beyond it; and the museum-like space Bonnie Bennett calls the Oriental Room -- all black lacquer and inlaid pearl, fur, satin and swirling mahogany -- is also gloriously

[109] McCrummen
[110] Ibid.

superfluous. "It's kind of stupid, because we never sit in here," said Bennett, who bought the largest house she could for the investment. [111]

The problems are not only that homeowners do not know what to do with those empty spaces, as the house size increases, so do the environmental impacts associated with buildings and development: resource consumption increases, the land area affected by development grows, storm water runoff increases as impermeable surface area increases, and energy use rises. In addition to carrying larger environmental burdens, larger houses cost more to build and operate. For single-family houses, "small is beautiful" in terms of environmental performance. Wilson explains in his reports [112]

Larger houses also consume more resources -- both in construction and during operation. The U.S. National Association of Home Builders (NAHB) estimates the materials used in building a 2,082-square-foot single-family house to include 13,837 board-feet of framing lumber, 11,550 square feet of sheathing, and 16.92 tons of concrete. One would expect that, relative to material use, there would be an economy of scale as house size increased -- that material used per unit area of floor area would drop as floor area increased. [113]

But that is not necessarily the case, according to Gopal Ahluwalia, the director of research at NAHB. Although NAHB has not compiled data on material use as a function of house size, Ahluwalia believes that, because larger houses tend to have taller ceilings and more features, larger houses may actually consume proportionally more materials.

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[111] Ibid.
[112] Wilson and Boehland, 278.
[113] Ibid.

He estimates that a new 5,000-square-foot house will consume three times as much material as the 2,082-square-foot house NAHB has modeled, even though its square footage is only 2.4 times as large. Even if Ahluwalia's intuition is not correct and larger houses are more material-efficient per unit area of floor, the higher ceilings and added features in large houses may mean that material use efficiency improvements with increased floor area of a house are not proportionate -- that is, that the increased material efficiency one would expect from purely geometrical calculations is not realized. [114]

Finally, the truth is that the larger amount of space in a house means that much of the home's volume is not used as much or as efficiently as the space in a smaller house. Rooms often are infrequently used; this is particularly the case with great rooms and formal dining rooms. And a substantial amount of a typical McMansion's square footage goes toward an open common area and large hallways aiding the maximum glamorous presentation, while the individual rooms in a McMansion, particularly secondary bedrooms, are often no bigger than in earlier housing.

5. Rethinking Our Home

The housing market began to soften in the winter of 2005 through the summer of 2006; and according to National home sales and price figures,[115] both fell again dramatically in March 2007 with sales down 13% to 482,000 from the peak of 554,000 in March 2006 and the national median price falling nearly 6% to $217,000 from the peak of $230,200 in July 2006.

[114] Ibid, 278-297.
[115] National Association of Realtors.

The plunge in existing-home sales is the steepest since 1989. The new home market is also suffering. The biggest year over year drop in median home prices since 1970 occurred in April of 2007. Median prices for new homes fell 10.9 percent according to the Commerce Department, and the National Association of Realtors reported that supply of unsold homes is at a record 4.2 million.

In March 2007, the United States' subprime mortgage industry collapsed due to higher-than-expected home foreclosure rates, with more than 25 subprime lenders declaring bankruptcy, announcing significant losses, or putting them up for sale.[116]

In 2008 and 2009, housing prices are expected to continue to fall and many homeowners who will be facing foreclosure will have to put their houses back on the market at a much lower price than what they spent because of the Subprime mortgage and Alt-A mortgage crisis.[117] We now realize that the crazy speculative fevers of the housing market were just another bubble and finally identified as the US Housing bubble; everyone who was enthusiastic of housing and the McMansion Phenomenon were floating on the bubble. Also the homeowners were living on their own bubble with bigger houses and larger debt.

Choosing the right home, especially the first one, is ranked among life's hardest decisions. For most households, the choice will have long-term ramifications on financial status, family planning, and physical comfort. It's a complex process that often involves striking a balance and making tradeoffs between several key aspects. Family

[116] Wikipedia contributors, "United States Housing Bubble."
[117] Subprime and Alt-A loans, including "stated income" loans, which are loans made to home buyers without the verification of their incomes; as home buyers tend to overstate their incomes in order to get the loan amounts they desire to purchase their dream homes. (Wikipedia contributors, "United States Housing Bubble.")

size, and its members' ages, education, ethnicity, income, and architectural aesthetics are all critical. Some buyers, for instance, search for a house that will raise their social status, or one that's near their own family's ethnic group or faith.[118]

However, in the past decade, the housing market has prioritized the aspects of the size of the house. Homebuyers wanted to find the largest house for the same amount of money, with a maximum loan from the bank. The value of houses was determined primarily by location and size, and unit cost. The institutions that dictated the value and resale of houses demanded more square foot than conventional wisdom of resale requirements. The value of the house was in its size and the architectural quality counted for little, and so we saw little of it. Most of the construction budget went into maximizing square footage and supplying status-symbol appliances, finishes, fixtures, and fittings. There was very little left over for architecture. The qualities of scale and proportion that mark good architecture were too intangible to be marketed as consumer goods; and so, little attention is paid to them.[119]

Today, however, I find optimistic opportunity to correct the McMansion Phenomenon in this difficult housing market situation. The expression "less is more" is attributed to architect Mies van der Rohe, a pioneering modernist whose taut, crisp, and restrained designs pointed the way to an architecture of great refinement and simplicity. His corollary dictum, "God is in the details," suggested that quality was more important than quantity.

[118] Friedman, 2005,196.
[119] Friedman, 2005, 36.

There are many architects who practice smaller scale houses, and there are many homebuyers that are waiting to be given the opportunity to purchase a house within their means. Some homebuyers are showing signs of becoming less interested in size than they are in quality. Sarah Susanka's book *The Not So Big House* (1998), which emphasizes a very different approach to house design -- one focused on quality, not quantity -- is selling extremely well. According to Taunton Press, over 360,000 copies have been sold. Two of Susanka's subsequent books also continue to sell well: Over 240,000 copies of *Creating the Not So Big House* (2002) and 50,000 copies of *Not So Big Solutions for Your Home* (2002) have been sold. A residential architect, Susanka argues for space-efficient houses with spaces that will be used. For example, she suggests eliminating the formal dining room in favor of a larger kitchen that provides both dining space and some informal living space.

And many other architects have been emphasizing space-efficient houses. In addition to providing open-plan living/dining/kitchen areas, the company suggests providing built-in furnishings and storage spaces, eliminating single-use hallways, designing multiple uses into rooms, and utilizing often-wasted attic and low-roof space. Rather than using up the budget to create the largest, most impressive house possible, many architects today suggest creating smaller houses with a higher level of finish quality and added amenities. "A house that favors quality of design over quantity of space satisfies people with big dreams and not so big budgets far more than a house with those characteristics in reverse," says Susanka. She argues that a good house designer should suggest to clients that, for a given budget, they reduce square footage to allow

high-quality detailing. Fine carpentry detailing, granite countertops, hardwood floors, labor-intensive but soulful salvage materials, and quality architecture can be far more impressive than sheer size.[120]

In the past decades it was the era of housing which was designed to impress rather than nurture and an increasingly affluent society wanted more, not less. Unparalleled economic booms in the second half of the twentieth century resulted in an explosion of housing cost, size, and housing befuddlement. Rather than taking advantage of low interest rates to further reduce the cost of a smaller house; people use it to trade up to a larger house. The higher cost of this larger house consists of higher mortgage payments, along with higher taxes, maintenance, and insurance. It also consists of higher opportunity cost. When we are maxed out on housing payments, we have little or no money left for other investments, including retirement accounts. The net result is a generation of homeowners struggling to pay for large homes they can't really afford and unable to save for retirement.[121]

We live in an age of astonishing excess, when having and wanting more is a cultural mandate. We use our brains and energy to work hard, and a big house is often the visible reward for our efforts. But a simple house might be a much better reward, because it takes even more brains and energy and, for that matter, taste, to live simply and modestly. The cost can be measurably less, and the rewards can be immeasurably more.

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[120] Wilson and Boehland, 283.
[121] Gauer, 11.

And yet simplicity and modesty elude us. Our lives tend to be complex and chaotic and difficult to manage. Rather than being a serene refuge from all this complexity and chaos, our homes are often an extension of it. And so they, too, are difficult to manage. This difficulty stems, at least in part, from their size: they are frequently too large.

We need to rethink our home. To reiterate: Le Corbusier called the house "a machine for living in."

6. Home improvement boom "America's Wish list"

There is an interesting survey[122] by *Better Homes and Gardens magazine,* responded to by nearly 60,000 Americans who shared their wishes regarding current home improvements and future home-building. According to the Editor in Chief, *Better Homes and Gardens*, Karol DeWulf Nickell, "Affordability and flexibility top America's wish list when it comes to their homes. People are hungry for ideas that fit their budget, and they want their home to work through all the changes their families go through. Inside, they're concentrating on kitchen improvements that can substantially increase their families' everyday satisfaction. Outside, they're looking to add living space to their yard or garden."

Following are the results of the survey.

[122] BHG.com. "American Homeowners' Wish List," Better Homes & Gardens magazine, January 11, 2005. http://www.bhg.com/bhg/story.jsp?storyid=/templatedata/bhg/story/data/BHBL_Survey_01112005.xml&catref=cat4180002&psrc=storyrl (accessed June 20, 2007).

The Wish for Affordability

Affordability is especially important due to a major rise in housing costs over the past 10 years. According to the survey:

- The average home improvement project costs the homeowner $12,427.
- DIY (do-it-yourself) is the most popular home improvement project with 86% of respondents working on their projects alone.
- 57% of Americans "pay as they go" when asked how they finance a home improvement project.
- 60% agreed that working with a homebuilder or contractor is a smart investment.

The Wish for Flexibility

Flexibility is perhaps the most revolutionary forward-looking trend identified. A house that incorporates a flexible design readily adapts to changes in family dynamics. Survey respondents indicated that:

- An enormous 68% of Americans are interested in shifting to a "work from home" lifestyle over the next five years, which could significantly impact the homebuilding and remodeling industry.
- People currently only stay in a home for 3-5 years due to expanding family, demonstrating a need for homes that can grow with families.

- 69% completed a major remodeling project within the past five years, and 42% plan to do so in the next five years, indicating that Americans are constantly changing their homes.

The Wish for Indoor/Outdoor Livability

Indoor/Outdoor Livability will play a more significant role in homes of the future than ever before. Outside areas are becoming extensions of the American home's indoor living spaces, with patios, barbeque centers, decks and other areas essentially serving as "additional rooms." Survey respondents said:

- Building a major garden or landscaping project is the second most popular home improvement choice among respondents asked what they would do with $20,000.
- The #1 reason that Americans give for remaining in an existing home is “watching something grow that I have planted,” such as a tree or garden.
- 88% of survey respondents said that “a neighborhood that’s walkable” is important to them more so, in fact, than spacious rooms or acreage.
- 92% said that “looking great from the curb” is an important quality in their selection of a home.

This survey reveals astonishing housing situations in American households. During the housing boom, many Americans paid top dollars to purchase their dream homes but find they are not happy and are constantly improving their house, or they are

planning to move to a new dream house every 3-5 years due to the change of their life style. And as soon as they settle into their current house, they are starting to think of improving their homes. Today home improvement is one of the most popular projects. According to the survey, the average home improvement project costs the homeowner $12,427, and the 86 % of respondents were working on their projects alone as DIY(do-it-yourself).

According to the survey, flexibility is perhaps the most revolutionary forward-looking trend identified. A house that incorporates a flexible design readily adapts to changes in family dynamics. Survey respondents indicated that: 68% of Americans are interested in shifting to a "work from home" lifestyle over the next five years, which could significantly impact the homebuilding and remodeling industry. Although 69% of them completed a major remodeling project within the past five years, 42% plan to do so in the next five years. This indicates that Americans are constantly changing their homes. And in spite of such changes, it is not enough. People currently only stay in a home for 3-5 years due to an expanding family, which demonstrates a need for homes that can grow with families.

The survey by Better Home and garden also revealed the absence of architects, as well as builders and building designers, on home improvement projects. The average home improvement project costs the homeowner $12,427. Although 60% agreed that working with a homebuilder or contractor is a smart investment. 86% of respondents are working on their projects alone as a DIY because by working with professionals, the cost of the project will be significantly increased. It seems Americans are spending too much

money for a big box which they are not completely satisfied with. They are continuously improving them to fit them into their current lifestyle; the cost of the box has already maximized their financial budget, and the opportunity for building professionals being used for remodeling projects is getting smaller. There are a lot of projects for houses requiring more than DIY.

In 2002, homeowners spent $173 billion remodeling their homes--up 10 percent from 2001--but only about 14 percent of that work involved an architect or designer.[123]

7. Changing Life Styles

Today our life style is definitely changing. Susanka realized that the old house was designed for a pattern of life that was fundamentally different from the way we live today. She knew that by building such a house we would be going out on a limb, because of all the extra spaces that we knew we would never use.

I do not advocate that everyone live in small houses. What I do suggest is that when building or buying a new home, we need to evaluate what really can make your family feel at home. In other words, concentrate on, and put more of your money toward what you like rather than setting sheer size and volume goals. We can do so by living well in smaller, skillfully designed dwellings of extreme simplicity and suitability. Such dwellings can actually deliver the good life that larger and more pretentious homes can only promise.

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[123] Editor, "News Letter,"*ArchVoices*, http://www.archvoices.org/pg.cfm?nid=home&IssueID=286 (accessed June 20, 2007).

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More modest housing will bring us several benefits, both quantitative and qualitative. The initial cost of construction will be lower, as will the cost of maintenance, especially fuel bills. Our lives will be calmer and more serene because the stress of shelling out timely payments for mortgage, taxes, insurance, and utilities will be reduced. And society will reap environmental benefits thanks to reduced consumption of limited resources.

Smaller dwellings will increase opportunities for better design because small spaces can intensify the architectural experience. More comfort and elegance will be possible, because architectural creativity and construction budgets won't be squandered on excessive square footage and fetishized "luxury" materials. Instead, budgets will be spent where they count: on the skillful manipulation of space, artfully designed plans, and use of sustainable materials with a floor plan that allows for continuity to live in; an adaptable, accessible and affordable house.

8. New approach of housing by Architects: Prefabrication

There are many ways to design a house. However, when homeowners are looking for well designed and innovatively tailored houses to fit their needs and able to be built within their budget, it is not an easy task. Predominant mass-market housing programs such as spec homes or tract housing largely fail to meet the desires of many Americans. Custom-designed modernist architecture is beyond the financial reach of many people. But prefabricated houses seem to have a better and wider possibility for today's new homeowners.

Today prefabrication has not yet reached its full potential in North America. Compared with progress in the electronics and auto industries, home construction is efficient yet archaic.[124] Prefabrication holds the potential for higher-quality homes that are fitted to the needs of the people that occupy them. In some countries-like Sweden, where 90 percent of all homes are prefabricated-a factory-built house is a mark of comfort and quality. In Japan, where prefabs are highly esteemed, builders have joined together to create housing show parks near major suburban cities. Clients visit show models and acquaint themselves with their technology and design. The next step often takes place in the client's home. A company representative sits down with the buyer and, with the aid of a computer, manipulates a generic design to make it fit the client's needs. When the design is finalized the order moves to the factory floor, where the parts are constructed by robotic equipment. Then they're shipped to the construction site for quick assembly. These prefab homes are more expensive than conventionally built ones, but the Japanese have accepted the fact that quality and choice come at a premium.[125]

The post-Second World War era saw the building industry employ mass production to a greater extent. The large-scale developments that were built to meet the overwhelming housing demand required new efficiencies. One solution was prefabrication; by 1951 one-fifth of an average house was made of components that were prefabricated in a plant. Mass-produced housing meant compact, efficient design, economical construction techniques, and persuasive marketing strategies. The popularity of these houses also led to the creation of nearly instant communities, and, of course, to

[124] Friedman, 2005, 156.
[125] Friedman, 2005, 157.

the virtual elimination of the skilled tradesperson and the architect from the building process. [126]

Prefabricated housing with SIP (Structural Insulated Panel) system has the possibility to provide a custom, modern home construction that is 30 percent stronger, 50 percent faster, safer, more flexible, predictable and healthier than the average new home construction. With these methods a home owner can have a quality home built at a traditional price or possibly at lower costs with exceptional energy efficiency and an environmentally friendly design

There is little question that the prefabricated house's popularity stems from its economic benefits. The degree of control afforded by factory manufacturing, the use of standardized components, and the dramatically abbreviated construction times have helped make prefabricated housing an appealing option for many builders, developers, and home buyers. The initial cost of the prefabrication might be high. But by establishing the system mass-productions, the cost of the prefabricated housing will dramatically decrease.

Despite of the advantages of prefabrication housing, however, in the United States, it is poorly regarded. And only 10 percent of all North American homes are built entirely in a factory. The success of factory-built homes is dismal. Over the years, they've demonstrated no economic advantage over on-site construction. This is because too often, aesthetics, comfort, and quality have been sacrificed for the sake of the bottom line. In the past, prefabricated houses have done a lot to earn their reputation for being cheap and

[126] Friedman, 2005, 132.

ugly. The majority of them tend to mimic stick-built housing types. Others are so poorly constructed as to merit ecological designer Jay Baldwin's contention that "many prefabricated house models are certainly CATNAP (Cheapest Available Technology Narrowly Avoiding Prosecution) and destined for early demise." Indeed, the prevailing vision of prefabricated houses associated with endless rows of charm-less, cookie-cutter structures built with cheap materials and substandard construction methods is, unfortunately, fairly accurate. [127]

Prefabricated housing dates back at least a century. The Sears Roebuck catalogue made prefabricated homes available to subscribers as early as 1908, and prefabrication was later explored by such eminent twentieth-century architects as Le Corbusier, Walter Gropius, Marcel Breuer, Frank Lloyd Wright, Albert Frey, and Jean Prouvé, who saw the technique as a natural solution to the problem of housing in modern society. And yet the design community seems never to have fully embraced prefabricated housing. With its acquired stigma of being tacky, cheap, and unsightly, "prefab"" has become more likely to conjure images of ratty triple-wide trailers or cookie-cutter suburban sprawl than of the elegant Los Angeles area Case Study Houses or the Usonian dwellings of Frank Lloyd Wright. Recently, though, there has been a renewed interest in prefabricated building as architects, designers, and theorists are looking at how to synthesize prefabrication's obvious economic benefits with the demands of aesthetic integrity and responsive design.

Interest in prefabrication grew in the first half of the twentieth-century, with the proliferation of industrial technology and the invention of the assembly line. Seemingly

[127] Friedman, 2005, 9.

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natural alliances were established between businessmen, industrialists, and architects to produce it, such as Albert Frey's [128]1931 Aluminaire House, a demonstration project of collaboration between the architect and the steel and manufacturing industries.

But many simultaneous and subsequent forays by designers into prefabricated housing met with little general success. Speaking of Buckminster Fuller's eccentric, circular carousel shaped 1929 Dymaxion House prototype; the author of the book, *Prefab,* Allison Arieff, suggested that "part of prefab's inability to capture public taste has been this Bucky Fuller approach of embracing the technology but not realizing the public sentiment."[129] In the early 1940s, Walter Gropius and Konrad Wachsmann attempted to develop a "Packaged House" system of customizable prefabricated dwellings, which was ultimately laid low by the difficulty of producing customizable prefab houses efficiently. After the Second World War, many munitions factories were converted into prefab manufacturing plants as part of the federally subsidized housing boom, but there was little involvement of the design community.[130] In 1950, Jean Prouvé was commissioned by the French government to devise a plan for mass produced housing, which was employed in a pilot program in Meudon, France, but was ultimately not adopted by the government. Many other initiatives, she said, "came to naught [for] reasons ranging from financing to unions to tornadoes, but we remain hopeful."[131] Pierre Koenig's 1960 Case

[128] Wikipedia contributors. "Albert Frey," Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/Albert_Frey (accessed May 20, 2007).
[129] Allison Arieff and Bryan Burkhart, *Prefab* (Layton: Gibbs Smith, Publisher, 2002), 18.
[130] Arieff and Burkhart, 21.
[131] Arieff and Burkhart, 23.

Study House #22 (Stahl House) "in all its perfection and simplicity really makes you want to fight for the cause."[132]

Today our tastes for a house are radically different from those in the 1940s, 1950s, and even 1960s, and our needs for a house are constantly changing. What Americans are looking for in today's market are affordable, flexible, simple and well designed homes.

Today, many of the prefabricated buildings are inexpensive and very functional and are far removed from the traditional "Sears" homes[133] and log cabins of the olden days. Designed by a new crop of architects who intelligently applied good design and the use of natural and sustainable materials, perforated housing in the future will change the way we feel and think about modern housing possibilities. There are the latest state-of-art, prefabricated factory constructions, which make it possible to build modern prefabricated housing ensuring a high level of quality control that in many cases surpasses conventional housing standards.

With the shortage of skilled labor, rising construction costs and the growing shortage of well-designed houses, prefabricated housing systems may well represent the home of the future. This project, I hope, presents an exciting options array for current and future homeowners and all those who care about smart design solutions.

Prefabrication provides a wider and greater possibility for architects to design affordable, flexible, simple and high quality housing to a wider population of new homeowners.

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[132] Ima Ebong, *Kit Homes Modern* (New York: Harper Collins Publishers, 2005), 30.
[133] Sears. Roebuck and Co, *Sears, Roebuck Home Builder's: The Complete Illustrated 1910 Edition* (New York: Dover Publication, 1990).

SECTION C
RESEARCH DOCUMENTATION

1. A History of Prefabricated Housing

Approximately seventy-two years ago, Raymond Parsons, an engineer at the symposium sponsored by House and Garden magazine said, "It can almost be taken for granted that when good prefabricated houses become a fact, their architectural style will be different from the quaint English cottages and Cape Cod Colonials that are the present favorites of the speculative builders. The idea that we should take new and better building materials and mould them into the lines and textures of old materials possessing any number of shortcomings is abhorrent."[134]

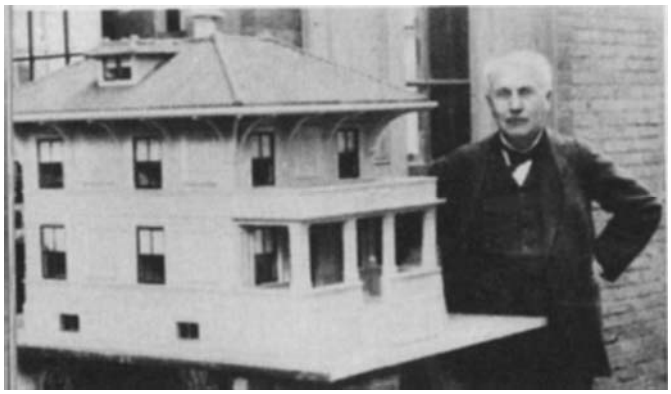
Despite numerous prefabrication groundbreaking proposals in the late thirties, the forties after World War II, and the sixties, from architects including Le Corbusier, Walter Gropius, Buckminster Fuller, Albert Frey, Jean Prouvé, Charles and Ray Eames, and Richard Rogers, little has changed.[135] Prefabricated building systems can be traced far back in history.

In 1624, a panelized wood house was shipped from England to Cape Ann to provide housing for a fishing fleet. A little over a decade later, the Swedes introduced a notched building-corner technique for log cabin construction. Because new settlements and colonies were being formed, an immediate need for housing arose, and by the nineteenth century the number of pre-fabricated housed had increased. Examples of

[134] Editor, "*News Lette,r*" ArchVoices.
[134] Allison Arieff and Bryan Burkhart, *Prefab* (Layton: Gibbs Smith, Publisher, 2002), 9.
[135] Ibid, 9.

those types of houses are kit houses and iron buildings. By the early part of the twentieth century, architects and inventors were experimenting with these systems for housing. J. A. Brodie from England developed wood-framed duplex units in 1904. Four years later,

Thomas Edison developed a poured-concrete house meant to provide workers with housing that was not only safe and affordable but also, as described by Scientific American, "artistic, comfortable, sanitary and not monotonously uniform:" However, it was never built because it was too heavy. [137]



1. Thomas Edison: Concrete House (1908)[136]

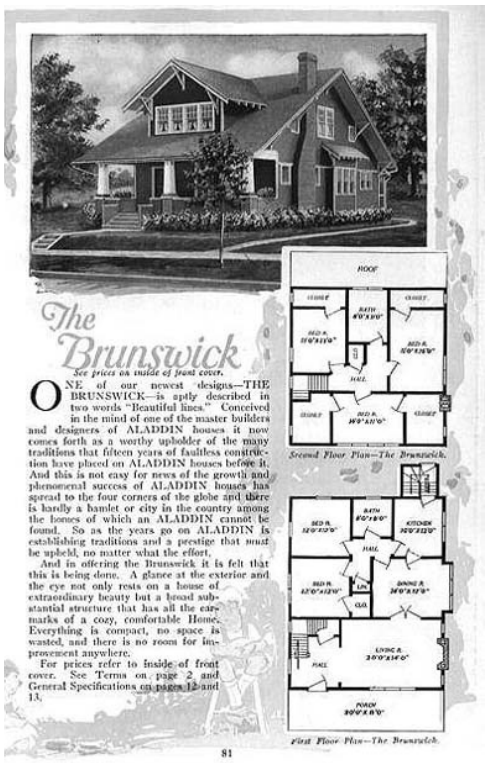
The first to successfully demonstrate the effectiveness of mass production was Henry Ford in 1908. The factory production of his Model T proved that this technique brought about lower prices and better quality, not only for automobiles, but many other consumer goods including prefabricated houses. By the late 1910s, a number of companies offered high-quality, precut, and prefabricated houses in a great variety of styles, with quality, affordability, and accessibility.[138]

Aladdin Readi-Cut Houses, founded in 1906, in the lumber town of Bay City, Michigan, was one of seven major firms that provided "kit" houses to the mass market. Aladdin was also the first company to offer a true "kit" house with pre-cut, numbered

[136] Source: http://exhibits.mannlib.cornell.edu/prefabhousing/prefab.php?content=two_a.
[137] Arieff and Burkhart, 13.
[138] Ibid, 13.

pieces, and who created the first mail-order houses in the United States. The other two kit-house companies located in Michigan were Lewis (Liberty) and Sterling (International Mill and Timber).

Starting from a small flyer for a "knock-down" boat house in 1906, Aladdin grew to publish a full color, hard cover catalogue of one hundred pages. Although they initially offered kit homes for simple affordable vacation homes, barns, and garages, their biggest business was selling Bungalow houses. Essentially the kits were simply made up of precut, numbered wood parts constructed as bungalows.[140]


The Brunswick

See prices on inside of front cover.

ONE of our newest designs—THE BRUNSWICK—is aptly described in two words "Beautiful lines." Conceived in the mind of one of the master builders and designers of ALADDIN houses it now comes forth as a worthy upholder of the many traditions that fifteen years of faultless construction have placed on ALADDIN houses before it. And this is not easy for news of the growth and phenomenal success of ALADDIN houses has spread to the four corners of the globe and there is hardly a hamlet or city in the country among the homes of which an ALADDIN cannot be found. So as the years go on ALADDIN is establishing traditions and a prestige that must be upheld, no matter what the effort.

And in offering the Brunswick it is felt that this is being done. A glance at the exterior and the eye not only rests on a house of extraordinary beauty but a house substantial structure that has all the earmarks of a cozy, comfortable Home. Everything is compact, no space is wasted, and there is no room for improvement anywhere.

For prices refer to inside of front cover. See Terms on page 2 and General Specifications on pages 12 and 13.

Second Floor Plan—The Brunswick.

First Floor Plan—The Brunswick.

81

2. The Aladdin Readi-Cut Homes: Bungalow Floor Plans (1920)[139]

The Bungalows were based on the then popular Arts and Crafts style much admired for its timeless quality, as well as larger Craftsman and Georgian Colonial Revival homes. Throughout the period of 1910 to 1940, Aladdin offered over 450 different models. Catalogues changed each year reflecting consumer preferences. These catalogues are highly prized for their creative graphics and art work.[141] These early kit houses sold well because they could be quickly erected in a day or less, which prompted

[139] Source: http://architecture.about.com/library/bl-bungalowplan-aladdin-brunswick.htm
[140] Ebong, 15.
[141] The Arts & Crafts Society, "The Arts & Crafts Movement: Aladdin," http://www.arts-crafts.com/archive/aladdin.shtml (accessed July 15, 20007).

the company to expand to fill the needs of the World War I generation, Savvy competitors like the famous Sears, Roebuck and Company quickly followed. [142]

At the end of World War I, dramatic population increases created a need for reasonably priced, well-constructed housing that could be erected quickly. Sears, Roebuck & Co. seized the opportunity, and became the first and most notable company to offer houses by mail and sold houses through its catalogs and sales offices to nearly 100,000 clients between 1908 and 1940.[144] At a time when information traveled slowly, Sears was able to reach a wide market through its catalogs, developing their infrastructure to serve its mainly rural clientele providing them with everything from clothing to housing. Along with the railroad network linking hundreds of cities and towns and the emphasis on all things modern and progressive, the stage was set for a revolution in building technology. Its first Book of Modern Homes and Building Plans featured twenty-two designs priced between $650 and $2,500.[145] From the start, efficiency of production was the key, and in its quest for speed and consistency Sears adopted

3. Sears, Roebuck & Co.: Kit Home (1908-1934)[143]

[142] Ebong, 15.
[143] Source: http://www.new-madrid.mo.us/index.asp?NID=78
[144] Arieff and Burkhart, 13.
[145] Friedman,2005, 152.

assembly-line mass-production techniques modeled on Ford automobile factory methods.[146]

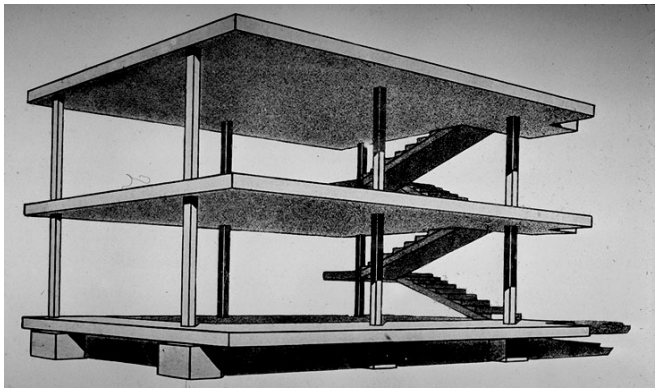
After the customer's order had been placed, the kit home was sent by rail direct from the factory. The precut numbered pieces were packed in two box containers. The "Balloon Style" framing cut construction time by forty percent, allowing houses to be quickly erected by one or two-man teams of carpenters who roamed from house to house to help customers put up their kit houses.[147]

Each House by Mail kit included lumber, nails, shingles, windows, doors, hardware, house paint, and instructions. All holes were bored and millwork provided, although the carpenter on site was still expected to trim the diagonally set sub-flooring and trim and miter external sheathing. Since power tools were rare and local sawmill prices could be exorbitant, pre-cut and notched lumber represented a remarkable advantage for home buyers. The affordable cost and ease of construction made home ownership a real possibility for blue-collar workers. It was Sears' goal to make acquiring a house as easy as buying a stove or chair. Its concept of packaging and shipping high-quality precut materials and precise instructions directly to the buyer was sound. The volume of homes sold allowed Sears to maintain flexibility and offer its clientele a wide variety of designs. Its skillful marketing strategy convinced thousands of Americans that a Sears house would offer them the comfort and security of their dreams. Their descriptions were alive, colorful, friendly, informative, and exaggerated.[148] As a result,

[146] Ebong, 17.
[147] Ibid, 17.
[148] Arieff and Burkhart, 13.

Sears was by then marketing over 100,000 items through its general catalog and some seventy special catalogs. Not only quality but also style was enthusiastically promoted to the rural consumer.[149]

During the 1920s and 1930s there were many parallel developments in domestic building. In fact, while Sears was beginning to slow down its production and trying to fend off the after effects of the Great Depression, an endless assortment of architects, manufacturing industries, commercial housing developers, and entrepreneurs created prefabricated housing kit prototypes with the hope of inventing the one silver bullet that would solve the housing crisis.[150]



4. Le Corbusier: Domino House, perspective drawing (1914) [151]

European countries were also in need of new housing after World Ward I, and thus turned to prefabrication because of the time and cost effective method of building. Britain, France, and Germany were developing prefabricated systems of concrete and steel while Sweden focused on wood systems. Perhaps the most architecturally significant of these early European developments in prefabrication came from the French architect. Le Corbusier. His 1914 Dom-Ino House had a new type of skeletal-framework

[149] Sears. Roebuck and Co. *Sears, Roebuck Home Builder's: The Complete Illustrated 1910 Edition* (New York: Dover Publication, 1990)
[150] Ebong, 17.
[151] Source http://www.usc.edu/dept/architecture/slide/ghirardo/CD3/022-CD3.jpg

construction of reinforced concrete that formed the floors, supports, and stairs of a building and eliminated the need for load-bearing walls. [152]

Le Corbusier was deeply committed to the democratic ideal of well-designed housing for the working class. The architectural quality of his working-class houses and apartments far surpasses that of typical middle- and upper-class dwellings today. The designs of Le Corbusier are especially noteworthy for their innovative open plans and generous windows, made economically feasible by mass production.[153]

He developed a number of mass-produced housing schemes and was a fervent advocate of the genre, as articulated in his spirited essay "Mass Production Houses" written in 1919; "If we eliminate from our hearts and minds all dead concepts in regard to the house, and look at the question from a critical and objective point of view, we shall arrive at the House-Machine; the mass-production house, healthy (and morally so too) and beautiful in the same way that the working tools and instruments which accompany our existence are also beautiful." Le Corbusier was instrumental, in the development of the International Style of architecture that would influence modern buildings over the next several decades.[154] Another early modernist who tackled the small house with artistic aplomb was the Viennese Adolf Loos, whose great gift was an ability to organize the spaces within a small house as complex geometric puzzles.[155]

Walter Gropius, the founder of the Bauhaus art school, the leading school of modern architecture and incubator of 20th-century modernism in Germany, had called for

[152] Arieff and Burkhart, 13.
[153] Gauer, 20.
[154] Arieff and Burkhart, 15.
[155] Gauer 21.

the industrialization of housing as early as 1910, and applying innovative industrial techniques to create mass· produced housing kits made from steel rather than the precut timber frames and historical nourishes that Sears used. [156]

Its development was one of the main goals of the Bauhaus effort to create "a new architecture for a new age." In 1923, working with Adolf Meyer, Gropius developed "Building Blocks;' a system of standardized flat-roofed housing, Three years later, he designed a construction system for a housing estate at Toerten-Oessau. There was no shortage of architects and engineers interested in exploring the possibilities of steel during this period. Muche & Paulick, Carl Kaestner Company, the Woefr Brothers, and Bruane and Roth all developed steel-house prototypes in 1926.[157]

In 1927 builders and architects were clearly interested in the promise of mass-produced houses and experimented with various materials and technologies. Robert Tappan introduced a steel-framed house and Buckminster Fuller, a visionary thinker, engineer, architect, and designer, introduced his design for what would later become the Dymaxion House. His goal was to provide efficiency in living, and he focused his efforts on designing homes that would have mass appeal and yet be practical

5. Richard Buckminster Fuller: Dymaxion House Prototype (1941-46) [158]

[156] Ebong, 22.
[157] Arieff and Burkhart, 15.
[158] Source http://www.arcspace.com/books/Steel_Beyond/images/4.jpg

both for the buyer and the environment. The Dymaxion House, hexagonal in shape and held together using tension suspension from a central mast, was a far cry from any conventional home and handily demonstrated Fuller's exhortation to "do more with less." The house had a living/dining room, two bedrooms, two bathrooms, a library, and even a sundeck on the roof. It could be easily disassembled, transported, and reassembled, reflecting Fuller's desire to create efficient shelter for better living.[159]

Fuller's Dymaxion prototype got a lot of press but not a lot of takers. The world might be ready for the Dymaxion House, suggested a 1932 headline in the New Orleans Tribune, "When We Live in Circles and Eat in Merry Go-Rounds." Fuller experimented with other Dymaxion designs, including a bathroom (a single unit holding a tub, toilet and sink, sliding doors, and heated metal surfaces) and a car (three-wheeled and fuel-efficient but unsafe at many speeds), but it would be another twenty years before Fuller saw his design built. [160]

The prefabricated housing industry was slow to expand. It took the depression in 1929 to generate a real interest in mass-produced housing in the United States with hope that housing starts would help stimulate the lagging economy.[161] Viennese emigre cum California modernist Richard Neutra was also experimenting with prefabrication around this time. He would even install prefabricated bathrooms in the very high-end Windshield House in 1938. Neutra's Lovell Health House, built as a demonstration house in 1928-29, had a lightweight prefabricated steel frame, and his Hollyridge Estate, built in 1932,

[159] Arieff and Burkhart, 18.
[160] Ibid, 18.
[161] Ibid, 15.

utilized standardized wood-chassis construction. Neutra's personal architectural philosophy, what he called ”biorealism,” emphasized man's relationship to nature and seamlessly merged prefabricated building materials like steel frames and glass with a natural aesthetic. Neutra's colleague and fellow Austrian Rudolph Schindler focused less on prefabrication than Neutra, but his use of concrete, flat roofs, and clerestories profoundly influenced the course of California modernism-a movement that would become intimately linked with the dream of innovative, affordable housing.[163]

6. Richard Neutra: Lovell Health House (1929)[162]

Albert Frey, a Swiss architect who had worked for Le Corbusier in Paris before moving to America in 1930, made his contribution to the prefab discourse with the Aluminaire. Conceived with his partner, architect A. Lawrence Kocher, the Aluminaire bore the distinct influence of Le Corbusier's work from the 1920s. Described by the architects as “A House for Contemporary Life,” the project was presented at the Allied Arts and Building Products Exhibition in 1931. Frey and Kocher solicited suppliers-including the Aluminum Company of America, the McClintic-Marshal Corporation (a subsidiary of Bethlehem Steel), and Westinghouse-to donate materials so the house could actually be constructed for the exhibition. It became the first all-light-steel-and-aluminum house built in America. The prototype was purchased at the 1931 exhibition by architect

[162] Source http://www.nbm.org/Exhibits/past/2001/images/Schindler/3.jpg
[163] Arieff and Burkhart, 18.

Wallace K. Harrison and rebuilt on Harrison's property on Long Island. Frey and Kocher experimented with other prefabricated housing types, including two prototype farmhouses, an Experimental Five-Room House, and an Experimental Weekend House. These innovative explorations with materials like steel, aluminum, and canvas no doubt contributed to the development of Frey's singular aesthetic, which, due to the lack of substantial developer and consumer interest, were never realized.[164]

The economic climate led Howard T. Fisher to develop the General Houses Corporation in 1932. This new company would act as an assembler of parts, ordered to its own specifications, that would then be produced by building-component suppliers (companies on board included General Electric, the Pittsburgh Plate Glass Company, and Pullman Car and Manufacturing). Seen as the General Motors of the housing industry, General Houses produced affordable homes ranging in price from about $3,000 to $4,500. The company's first house was built for Fisher's sister-in-law in 1929. General Houses went on to produce a number of model homes made from pressed steel based on standardized parts designed by Fisher, who was optimistic about the public's taste for contemporary advances in housing.[165] "The final decision in the matter of design will of course depend on what the public wants," he explained at a symposium sponsored by House and Garden in 1935, "But in everything else the public has shown a preference for the best in modern design, and I doubt it will pay extra for fake imitations of the past when they buy their houses." Fisher's predictions about public taste would ultimately

[164] Arieff and Burkhart, 19.
[165] Allian D. Wallis, *Wheel Estate: the rise and decline of mobile homes* (New York: oxford University press, 1991), 135.

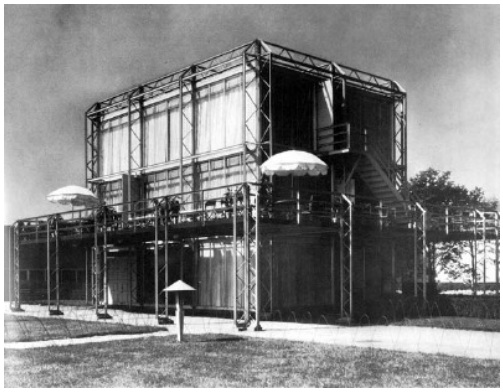
prove to be off the mark - Americans just weren't ready for houses straight off the assembly line. But before that became apparent, other companies-including American Homes, American Houses, Inc., and the Homosote Company optimistically followed his lead[166] [167]

Robert McLaughlin of American Houses, Inc. introduced his own brand of prefabricated houses known as American Motohomes. The steel-framed houses ranged from a six-bedroom, four-bathroom, two-car-garage model to a simple four-room home. Each house, promised McLaughlin, possessed "durability, beauty, economy, and convenience to a degree the world has never known before." The components were fabricated in a factory in New Jersey and then assembled on-site. The turnkey houses even came "complete with food in the kitchen." The flat-roofed, geometric residences that subtly referenced the International Style did not have the mass appeal that McLaughlin had anticipated, however, and American Houses, Inc., abandoned the Motohome for more conventional prefabricated home building.[168] [169]

[166] Arieff and Burkhart, 15-16.
[167] Jandl, H. Ward. Yesterday's House of tomorrow: innovative American Homes, 1850-1950. The preservation press, national Trust for Historical Preservation, 1991, 72.
[168] Ibid.
[169] Arieff and Burkhart, 17.

Steel was increasingly becoming an integral part of the housing industry in the thirties. Several steel producers were backing research on its use for prefabrication. A number of steel-prototype houses generated from that research were presented at the Chicago World's Fair in 1933. Builder George Fred Keck"s House of Tomorrow and Crystal House were both displayed at the fair's Century of Progress Exhibition. Each exhibition house was supported by a steel framework and steel-deck floor system. A standout at the exhibition, Keck's House of Tomorrow was an eye-catching, three-story, twelve-sided structure built on a steel frame. It featured glass walls and even an airplane hangar (complete with a small Curtiss-Wright sport biplane inside) on its ground floor. The house had central heating, air conditioning, and window-shading devices to control the level of incoming light. Keck took advantage of the cost savings from the house's prefabricated elements and applied them to quality-of-life features such as large outdoor decks, frosted glass walls in the bathroom, a built-in aquarium in the children's room, and the latest technological innovations in the kitchen. More than

7. George Fred and William Keck:The House of Tomorrow, (1933)[170]



8. George Fred Keck: Modular theatrical truss and Crystal House (1934)[171]

[170] Source http://www.preserveindiana.com/images/dangerpix/hos_tom.jpg.
[171] Source http://radio.weblogs.com/0119080/images/Gallery/crystalhouse.jpg.

750,000 people toured the House of Tomorrow in the first year of its exhibition. No commissions were forthcoming, but the house's popularity did enable Keck to build a second house for the exhibition, even more radical than the first.[172]

Keck's Crystal House had an innovative prefabricated structural frame that was erected in just three days, but its bold constructivist aesthetic was a bit too radical for the average home buyer. That, combined with its less-than-prime location on the fairgrounds, got in the way of its success. The house was sold for scrap at the end of the season; its materials and furnishings were auctioned off by Keck to pay the bills. A Chicago real estate developer purchased the House of Tomorrow along with six other fair houses. The group was then loaded onto a barge and transported to Beverly Shores, Indiana. Keck and his younger brother William continued to build prefabricated houses, including some that made use of passive solar concepts.[173]

Another independent spirit, architect Frank Lloyd Wright also took on the challenge of creating a well-designed, affordable house. When potential clients Herbert and Katherine Jacobs arrived at his studio at Taliesin in 1936 with a proposition to design "a decent five-thousand-dollar house," he gladly accepted, telling his new customers that he'd wanted to design a low-cost house for years but that no one had ever asked. And so, the first Usonian House was designed and built, and they set the bar for architectural ambition in small houses as high as it has ever been.[174] From 1929 to 1943, he designed over fifty small, moderately priced houses, in sizes starting at 870 square feet. These

[172] Arieff and Burkhart, 16.
[173] Ibid, 16-17.
[174] Ibid, 19.

houses typically had an open plan in which entry, living, dining, kitchen, and working spaces flowed together around a central fireplace and service core. Generous use of casement windows and French doors blurred the line between indoors and out, thus expanding the perceived space.[175]

For his Usonian houses, Wright had developed not a prefabricated system per se but rather a grid system that established regular, modular dimensions for the wooden houses. This grid allowed for maximum design flexibility and also unified the group of buildings. Each design, however, was unique. The repetition of standard details reduced costs, as did the elimination of items considered standard for most other single-family homes. The features deemed unnecessary included a visible roof, a garage (a carport was provided), a basement, and roof gutters. More radical in their absence were radiators, light fixtures, furniture, bric-a-brac, paint, and plaster. People living in a Wright house had to accept quirks along with his genius. They wore sweaters in the winter and learned to live with built-in furniture.[176]

Wright was inspired rather than hindered by the cost restrictions. The "obstacle" made the process more interesting. "The house of moderate cost is not only America's major architectural problem but the problem most difficult for the major architects," Wright told Architectural Forum in 1938. "As for me, I would rather solve it with satisfaction to myself and Usonia, than to build anything I can think of at the moment."[177]

[175] Gauer, 21.
[176] Arieff and Burkhart, 19.
[177] Ibid, 19.

In 1942, architects Walter Gropius and Konrad Wachsmann, who had both immigrated to the U.S. from Germany during the war, formed the General Panel Corporation hoping to capitalize on their extensive knowledge of prefabrication and Wachsmann's advanced panel system. The company's first project was the Packaged House System, a kit home created from a system of standardized framed wood panels. The first prototypes were created in 1943; they had hoped to produce 10,000 houses a year and received loans with that schedule, however, the project never left the boards.

The architects continued to develop structures using General Panel Corporation components. Other systems like the prefabricated panel developed by Howard T. Fisher also facilitated functionality and low cost, but most of the houses utilizing these systems tended to be boxlike, with none or few of the planning innovations advocated by early-twentieth-century modernists.[178] By 1948 they managed to produce and sell just fifteen houses, but by then the housing shortage crisis was beginning to improve and correspondingly interest in factory-made packaged kits peaked. Consumer tastes were beginning to return to more conventional housing. In 1951, the General Panel Corporation was liquidated and yet again the dream of the factory made house was postponed indefinitely.[179]

In 1932 the Museum of Modern Art in New York presented its first architectural publication, The International Style: Architecture Since 1922, thereby introducing the United States to European modernism. The philosophy and style of this esteemed group of modernists would exert tremendous influence on U.S. architects. The International

[178] Arieff and Burkhart, 21.
[179] Ebong, 22-25.

Style did not have a major impact on home building in its American infancy, but its impact on the course of architecture over the next thirty years was immeasurable.[180]

Aladdin, Sears and other similar companies in the United States were enjoying moderate success with the sales of their kit houses and saw no reason to embrace the industrial aesthetic of the Internationalists.[181] Universities, art museums, and the rare adventurous client may have been ready to accept the innovative concepts of visionaries like Fuller, Wright, and Gropius, but the average consumer wasn't there yet-even for the decidedly less radical houses of builders McLaughlin and Keck. The conventional housing industry's primary goal in the thirties was to simply make residential design and construction more practical and, by extension, more inexpensive. And home buyers didn't seem too troubled by that business decision.[182]

It is not wholly surprising that design innovation was not a major concern at a time when housing of any sort was desperately required. Government agencies stepped in to help improve the housing situation with new legislation, but the growth of the prefabricated housing market was slow. Between 1935 and 1940, prefabricated homes accounted for about 10,000 homes, or just less than one percent of the nation's total production for that period. By 1940, there were only thirty firms manufacturing this sort of house. A new infusion of government support after the war would soon help to stimulate that growth significantly. Further, trailer homes were slowly gaining in

[180] Arieff and Burkhart, 15.
[181] Ibid.
[182] Ibid 19.

popularity during this period, though financing of these ostensibly portable homes remained problematic.[183] [184]

Approximately 18,000 prefabricated homes had been built by the end of 1941. The housing crisis continued to be so dire that President Harry Truman appointed Wilson Wyatt as Housing Expediter in 1946 to help stimulate the production of housing for veterans returning from the war as part of the Veterans' Emergency Housing Program.[185] Prefabricated housing played a large part in Wyatt's proposal to Truman. "The Expediter" hoped to have a quarter of a million prefab units under construction in 1946 and an additional 600,000 the following year. "We can meet this need only by bringing to bear the same daring, determined and hard hitting team work with which we tackled the emergency job of building the world's most powerful war machine four years ago," Wyatt stressed in a 1946 report to President Truman. The promise of federal support to prefabrication builders significantly helped to stimulate growth in the industry. Their number nearly tripled-up to 280 in 1946 from just 100 the year prior.[186]

At about the same time as Sears' ceased production, two architects from Germany began work in the United States on a factory made house. Walter Gropius, founder of the Bauhaus, and Konrad Wachsmann developed their idea in 1941, incorporating flexibility into the design of what later became known as the Packaged House. Having received funding from private sources as well as government loans and guarantees from the National Housing Administration, Gropius and Wachsmann acquired a large war surplus

[183] Wallis, 96-99.
[184] Arieff and Burkhart, 21.
[185] Ibid, 21.
[186] Ibid, 23.

factory that could produce thirty thousand houses per year. Only a very small number of houses were produced and sold.

By the 1950s the venture had collapsed, again not for technical or architectural reasons but for those related to marketing, research, and development. The competition with conventional builders of housing was too great, as the public tended to choose the most affordable options. Gropius and Wachsmann also wasted time and resources in moving the initial concept to the final production stages. They had used up half a million dollars before production began, leaving them without adequate financing. The unprofitable early years discouraged further investment, and the business dissolved for want of production capital.[187]

When World War II ended, there became a housing shortage. It was urgent that the issue be addressed by the need to provide homes for returning soldiers. A 1940 issue of The Forum magazine noted, "The end of the Second World War ushered in a boom in prefabricated housing using new materials and methods developed during the war years. Most pressing was the need to house returning soldiers and their growing families, which spurred the second wave of interest developing mass-produced factory built home kits."[188]

In 1944, a government guaranteed financing program that had been established under the auspices of the Veterans Administration mortgage program, also aided this expansion. This new program was far more effective than Wilson Wyatt's, which had suffered greatly with the defeat of the Democrats in 1946. With the incentives of the

[187] Friedman, 2005, 153-154 .
[188] Ebong, 17-18.

guaranteed-mortgage program, housing starts jumped from 937,000 in 1946 to 1,692,000 in 1950. Though prefabricated housing builders often had difficulty obtaining these mortgages (a problem that continues to the present day), several companies ventured into the rapidly expanding housing industry with varying degrees of success. In addition, the Housing Act of 1949 was passed in continuing recognition of the national and pervasive housing crisis following World War II.[189]

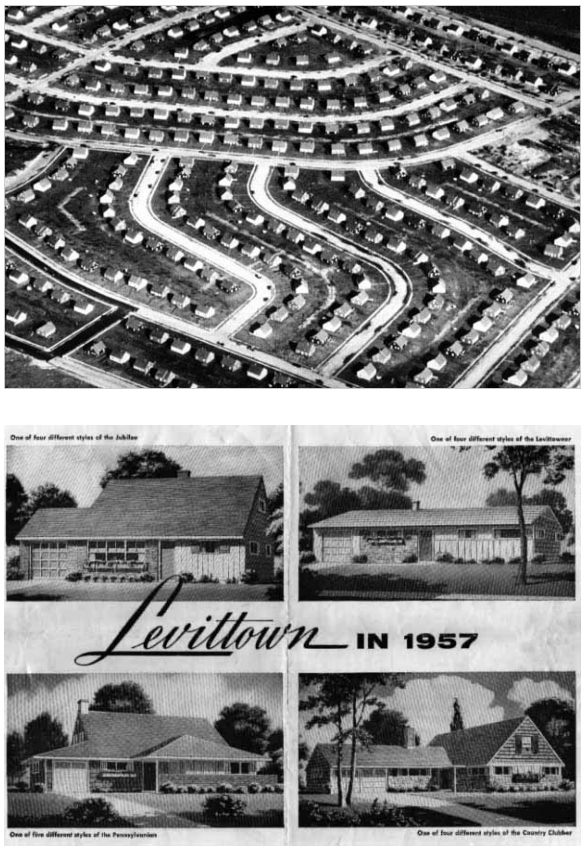
Though the 1940s was a period of time when easily available government loans and tax incentives made it favorable for architects to get into the housing business. The field of factory made housing was occupied by a tight amalgam of tough, highly competitive business interests made up of property developers, industrialists, and assorted manufacturers who were anxious to generate new markets for their raw material.[190]

Therefore, modern architects tended to be wedged in between commercial interests that often left little room to maneuver. It is notable that a businessman/property developer and an engineer/entrepreneur were the ones who initiated mass-produced housing kit projects.

The initiative belonged to savvy business men like William Levitt, the genius behind the large-scale housing developments of Levittown, who saw the coming need for housing and swiftly stepped in to fill it.[191]

[189] Arieff and Burkhart, 25.
[190] Ebong, 21.
[191] Ibid, 18, 21.

Developer William Levitt was very adept at making the new government legislation work for him. Levitt, inspired by Ford, pioneered mass-produced construction techniques that helped the housing industry meet the overwhelming demand. This was due in large part to the size of Levitt's operation. The more houses built, the lower the overall cost. Further, Levitt brought the factory to the site, where workers poured foundations, erected frames, installed plumbing, and so forth. Even more crucial to his success, Levitt focused not on individual homes or on individual sites but on an entire housing community, filled with Levitt-built homes which allowed him to assure all prospective home buyers that their homes were eligible for FHA or VA financing.



9. William Levitt: Levittown, N.Y (1948)[192]

The building firm, Levitt and Sons, headed by Abraham Levitt and his two sons, William and Alfred, built four planned communities called Levittown in New York, Pennsylvania, New Jersey and Puerto Rico between 1947 and 1951. It was the first truly mass-produced suburb using the most novel and up-to-date of building methods. The

[192] Source http://www.nytimes.com/slideshow/2007/10/12/nyregion/20071013_LEVITTOWN_SLIDESHOW_5.html.

firm offered affordable housing to returning veterans and their families on the housing shortage of the immediate postwar years.

Levitt was a master publicist, and he understood that to make his community a success, he needed to present it as a new form of ideal American life, one that combined the idealized middle-class life of the pre-war suburban communities, with the democratized life of younger, mainly urban-raised veterans and their families. [193]

The first Levittown development was created on what used to be potato farms in an area previously known as Island Trees, in Long Island, New York in 1947. Levitt and Sons publicly announced their plan to build 2,000 mass-produced rental homes for veterans on their Island Trees land. Two days later, the New York Herald Tribune reported that 1,000 of the 2,000 proposed homes had already been rented. Levittown, as the new development would eventually be named, was off to a booming start. To build their homes cheaper and faster, Levitt and Sons wanted to eliminate basements and build on concrete slabs instead. This practice was prohibited in the local municipal town but, because the need for housing was so urgent, the town modified their building code to allow the Levitts to proceed with their own plan.[194]

Levitt and Sons used many of the building methods they had used over the years in previous developments but reorganized these methods for even better efficiency and cost savings. Using the unrelenting efficiency of updated factory assembly techniques, mass-produced cookie-cutter kit houses were created for the lowest possible cost. Every

[193] Barbara M Kelly, *Expanding the American Dream: Building and Rebuilding Levittown* (New York: State University of New York Press, Albany, 1993).
[194] Wikipedia contributors. "Levittown, New York."

part of the house was standardized and churned out at a factory according to exacting specifications. All the lumber was precut and shipped from a lumber yard they owned in Blue Lake, California where they erected a nail factory as well. An abandoned rail line was re-opened to bring construction materials to Island Trees. To keep costs down, although met with heavy opposition, non-union contractors were used. Housing parts were packed in a container and trucked to the 1,400-acre Levittown housing development, where scores of workers, aided by construction machinery, formed the largest outdoor work site, erecting house after house in neat, monotonous identical rows. The production line technique used to build this new development was so successful that, by July 1948, the Levitts were turning out 30 houses a day. Even at this pace, the Levitts couldn't keep up with the demand. Although all 2,000 homes had been rented almost immediately, hundreds of veterans were still applying, so the Levitts decided to build an additional 4,000 houses. The community soon had its own schools, its own postal delivery, even phone service and streetlights.[195] [196]

In 1949, Levitt and Sons discontinued building rental houses and turned their attention to building a larger, more modern house, which they called a "ranch" and which they would sell for $7,990. All a prospective buyer needed was a $90 deposit and payments of $58 per month. The Levitt ranch measured 32 feet by 25 feet and came in five different models, differing only by exterior color, roof line, and the placement of windows. Like previous Levitt homes, the ranch was built on a concrete slab with radiant heating coils, and had no garage. The typical Levittown ranch house in 1950 had an

[195] Kelly.
[196] Wikipedia contributors. "Levittown, New York."

entrance foyer, a living room with log-burning fireplace, two bedrooms, a kitchen, a bathroom, and a porch or carport. The kitchen was outfitted with a General Electric stove and refrigerator, stainless steel sink and cabinets, the latest Bendix washer, and a York oil burner. Other features included copper radiant heating, aluminum venetian blinds, insulated glass, and a built-in TV set area built into the living room staircase. The 1951 model included a partially finished expandable attic. Thousand Lanes, a magazine devoted to the decorating, expanding, and remodeling of Levitt homes became a must-have for Levittown residents. Shopping centers, playgrounds, and a $250,000 community center sprang up to accommodate Levittown's active residents.[197] [198]

Immediately, the demand for the new Levitt ranches was so overwhelming that even the procedure for purchasing them had to be modified to incorporate "assembly line" methods. Once these techniques were put into action, a buyer could choose a house and sign a contract for it within three minutes. So great and so far-reaching was the success of the Levittown community that on July 3, 1950 William Levitt was featured on the front cover of Time magazine. This success continued throughout 1950 and 1951, by which time the Levitts had constructed 17,447 homes in Levittown and the immediate surrounding areas. As the GI homeowners settled into well-paying jobs and began to spawn families, the Levitt models and the surrounding community were modified to suit the needs of growing families. Although the massive clusters of standardized houses looked rather depressing, it did not stop aspiring homeowners. In 1953, a writer in Harper's observed that all that exterior sameness was not a problem, as the standardized

[197] Kelly.
[198] Wikipedia, the free encyclopedia, “Levittown, New York”.

house appeared to have created "an emphasis on interior decorating. Most people try hard to achieve something different. In hundreds of houses, I never saw two interiors that matched and I saw my first tiger-striped wallpaper."[199] Levitt also cleverly surrounded some of his mass-produced kit home settlements with parks, wide streets, pavements, and areas to congregate and play. For better or worse, as the first and one of the largest mass-produced suburbs Levitt's brand of community development set the standard for future housing systems. Although Levittown provided affordable houses in what many residents felt to be a congenial community, the accusations against Levittown from the first focused on its relentless homogeneity, blandness, and racial exclusivity; the initial lease prohibited rental to non-whites. The cramped quarters of its interiors, and the raw, unfinished quality of its landscape were also criticized.[200] [201]

The critics were judging from an older, more elite standpoint-- they were, themselves, idealizing an American landscape inappropriate to Levitt, to his constituency, or to the moment in which Levittown came to be. Theirs was a suburb devoted to upper-middle-class conservatism; they looked to precedents in the custom-built housing communities built before the war, some of them by Levitt and his family. Levitt owners, however, understood their new houses in the context of the ones they were leaving-- multi-unit brick, stone or frame apartment complexes within the boroughs, buildings that were themselves often laid out ten, twenty, thirty at a time in a relentless self-replication that is still visible along streets in Brooklyn, Queens, and even Manhattan. If you grew up

[199] Arieff and Burkhart, 27.
[200] Kelly.
[201] Wikipedia, the free encyclopedia, "Levittown, New York".

in those apartments, the aesthetic and philosophical objections of Levittown weren't quite so visible.[202]

Today, "Levittown" is used as a term of derogation to describe overly-sanitized suburbs consisting largely of tract housing. Oddly enough, although Levittown is remembered largely for its homogeneity and conformism, the houses of Levittown have by now been so thoroughly expanded and modified by their owners that their original architectural form can be quite difficult to see.[203] [204]

Unlike architects, commercial developers and businessmen seemed more nimble, more able to step back from their projects and evaluate problems with the unvarnished bottom line in mind. In contrast, for many of the key modern architects who tried their hand at prefab mass housing, design integrity was the only bottom line. With the exception of a few committed developers like Joseph Eichler, who sought out the best modern architects for his housing projects, it seemed that for more commercially minded property entrepreneur's modernism was not an article of faith but a marketing strategy useful along with the latest General Electric appliances and kitchen cabinets as a means of enticing consumers. For modern architects, on the other hand, good design was key and could not be separated from issues of affordability or construction technology.[205]

[202] Kelly.
[203] Wikipedia, the free encyclopedia, "Levittown, New York".
[204] Ebong, 18-19.
[205] Ibid, 22.

In 1949, developer Joseph Eichler, Levitt's West Coast counterpart and founder of Eichler Homes, Inc., considered such repetition unacceptable. Levitt's standardized houses used 2 x 4 construction, while Eichler utilized post-and-beam construction to create his new modern homes. Most builders typically didn't hire architects to design houses, but Eichler did. He wanted to make money, of course, but he was also intent on designing houses of the highest quality. Like Levitt, Eichler focused on acquiring entire subdivisions, but his decisions incorporated more quality of-life aspects such as green space and cul-de-sacs to reduce traffic. Eichler houses had other innovative features like an open plan, glass walls (including an airy inner atrium, which would become the hallmark of Eichler homes), and a second bathroom at a time when most homes had only one. Once Eichler Homes made the second bath a standard feature, other builders had to follow suit. Influenced by Frank Lloyd Wright and California modernists including Richard Neutra, Eichler houses embraced the California landscape, and their architecture emphasized the relationship between inside and out. Young first-home buyers were drawn to the modern lifestyle that Eichler Homes promised.[207]

10. Joseph Eichler: Eichler Homes (1955)[206]

[206] Source http://www.eichlernetwork.com/ENStry25.html
[207] Arieff and Burkhart, 27.

Another prefabricated factory-made solution created to alleviate the post-World War II housing crunch was the Lustron kit house. In 1947, engineer and inventor Carl Strandlund, who had worked with constructing prefabricated gas stations, obtained a multi-million-dollar Reconstruction Finance Corporation loan to manufacture steel houses with porcelain-enamel-coated panels. In 1948, the Lustron Corporation began producing prefabricated, all-steel houses in a ·surplus wartime aircraft factory that had been used to build Curtiss-Wright fighter planes. The idea for a prefabricated, all-steel dwelling wasn't new, but Lustron founder Carl Strandlund was initially more adept at marketing it than his predecessors.[208]

Shipped as a kit of parts, the disassembled house was packed into one large container and transported directly from the factory to the site by truck. The steel in the houses was an original design, including both steel framing and steel interior walls and ceiling, while most houses were constructed with wood framing and plaster walls on wood. The promise of steel included sturdier construction, reduced maintenance, and ease of pre-fabrication. In addition, the houses were pitched as rodent-proof, fire-proof, lightning-proof, rust-proof and maintenance-free. Each house included a washing machine, an innovative built-in radiant heating system, a dishwasher, and furniture. The skeletal frame was made of steel to which wall sections were welded. The roof, as well as the exterior and interior walls, was made out of interlocking steel panels coated with a porcelain enamel finish sprayed on at the factory.[209] [210]

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[208] Arieff and Burkhart, 23.
[209] Ibid, 21.
[210] Wikipedia contributors. "Lustron house," Wikipedia, The Free Encyclopedia. http://en.wikipedia.org/wiki/Lustron_house (accessed May 2, 2007).

The houses would sell for between $8,500 and $9,500, according to a March 1949 article in the Columbus Dispatch, about 25% less than comparable conventional housing; by November 1949, the average selling price had come up to $10,500. The Lustron Corporation declared bankruptcy in 1950, despite being an extremely well-funded, well-publicized, government-supported enterprise manufacturing a desperately-needed product. Production delays, the lack of a viable distribution strategy, and the escalating prices for the finished product all contributed to the failure. Some accounts suggest an organized effort from the existing housing industry to stop Strandlund, comparing him to Preston Tucker.[211]

While traditional looking mass-produced housing kits bearing names like Sears, Levitt, Eichler, and Lustron, were being hailed as miracle solutions to the housing crises between the war years, modern architects were still struggling to put their own stamp on the domestic housing crisis. Though they tried hard to come up with prefabricated homes created with the latest machine-age technology, the modernist road to the factory built kit house ended up being littered with abandoned prototypes. Among the many reasons that modern architects failed to make a lasting impact in the notoriously difficult area of factory-built prefab housing was the nature of the competition architects faced.[212]

In 1945, a housing program was introduced that became the standard by which all other attempts at well-designed, affordable single-family homes were measured. Like many of the housing schemes initiated after the war, the Case Study Houses program was fueled by the rising demand for affordable single-family homes and the need to house a

[211] Wikipedia contributors. "Lustron house."
[212] Ebong.

generation of GIs returning from the war. But unlike every other housing program, the Case Study program was launched not by a builder, developer, or even an architect, but by John Entenza, the enigmatic editor of Arts and Architecture magazine. Entenza's vision provided an extraordinary opportunity for a generation of American and émigré architects to pursue an unprecedented experiment in modern domestic architecture. Over the course of twenty years, thirty-six Case Study Houses were designed and built, each intended as a model for future construction on a mass scale. Architects such as Edward Killingsworth, Charles and Ray Eames, Richard Neutra, Raphael Soriano, Craig Ellwood, and Pierre Koenig proved they could build cost-effective homes without compromising modernism's utopian principles.[213]

Charles and Ray Eames, the famous 20th-century husband-and-wife architect and design team, also tried to create an innovative home building system that relied on a kit of parts, and designed one of the first Case Study Houses for themselves. The colorful, airy home and studio located in the hills of Pacific Palisades openly celebrated its steel frame structure and came to symbolize the California modernist lifestyle. Their iconic Case Study House #8 represented a bold development in off-the shelf housing and was a living laboratory of sorts in which the creative possibilities

11. Charles + Ray Eames: The Case Study House #8 (1949) [214]

[213] Arieff and Burkhart, 27.
[214] Source http://farm2.static.flickr.com/1067/556643076_73dd0352e2_o.jpg

inherent in industrial materials and components were exuberantly explored in the context of the practical realities of everyday life. Case Study House #8 was an important precursor to a new prefabricated kit house, which the architects called the Kwikset. As the plans and drawings reveal, the unbuilt house was an imaginative and sophisticated mix of glass, wood, and steel. Had the Kwikset been realized, it 'would have made a wonderful follow up to Case Study House #8 The design demonstrated that standardized factory made components need not result in sterile, endlessly replicated static designs, but instead could result in flexible kits of parts that could allow architects to more playfully and efficiently explore an endless combination of creative housing options. Sadly the Kwikset house project never got past the drawing board. [215]

Architect Craig Ellwood designed three Case Study Houses #6, 17, and 18-between 1952 and 1958. All three were low-slung, flat-roofed, single-story structures of steel and glass. The former engineer's appreciation of prefabricated technologies inspired him to leave the houses' steel frames exposed. “The increasing cost of labor and the growing lack of craftsmen-our expanding machine economy-will more and more force construction into the factory where units will be manufactured for fast job assembly,” he explained to Progressive Architecture in 1959.[217]

12. Craig Ellwood: Case Study House #16 (1953)[216]

[215] Ebong, 30.
[216] Source http://www.arcspace.com/books/Ellwood/Photo-3.jpg

Other Case Study House architects like Pierre Koenig created innovative prototypes that also pointed the way to using mass producible factory fabricated industrial components to create beautifully designed affordable modern homes. He also used steel-frame structures and industrial technology to generate his own architectural style. Koenig's 1959 Case Study House #21, the Bailey House, was essentially composed of a kit of parts containing steel frames and beams as well as concrete and glass panels. His work always stressed the importance of the natural expression of materials rather than gratuitous ornamentation. [219] [220]

13. Pierre Koenig: Case Study houses #21 (1959) [218]

Recognizing the housing shortage as a window of opportunity, Buckminster Fuller reintroduced his Dymaxion concept during the war. Presented to the United States military as the awkwardly monikered "Airbarac Dymaxion Dwelling Machine," this housing complex was designed to easily accommodate officers' housing, barracks, and a four deck hospital ward. Fuller designed a structure to be built from aluminum, which was, at the time, the alloy developed for warplane construction. Despite its many

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[217] Ebong, 30.
[218] Source http://blog.aia.org/mt-static/plugins/Ajaxify/tinymce/jscripts/tiny_mce/plugins/imagemanager/images/favorite_architecture_images/stahl_twelve_600_x_548.jpg.jpg.
[219] Ebong, 30.
[220] Wikipedia contributors. "Case Study Houses."Wikipedia, The Free Encyclopedia. http://en.wikipedia.org/wiki/Case_Study_House (accessed April 20, 2007).

advantages, the government rejected Fuller's idea due to a lack of the necessary building materials.[221]

Meanwhile, in Kansas, the Beech Aircraft Company needed housing in order to keep a rapidly dispersing workforce from seeking employment in other industries. The company saw the Dymaxion Dwelling Machine as a good option. Fuller's small, lightweight house was inexpensive, easy to maintain, and built to withstand Kansas tornadoes. But its unconventional round shape, coupled with labor disputes and Fuller's refusal to comply with his investors' guidelines, caused the project to fall apart. One prototype house was built in Kansas.[222]

Fuller's continuing fascination with housing systems that were compact and transportable continued. In 1948, he gave his students at the Institute of Design in Chicago the task of designing a "Standard of Living Package," a container, transportable by trailer, that could hold complete furnishings for a household of six. And later that year, he would develop his first geodesic structures. In 1949, Fuller presented his design for the Wichita House, which consisted of lightweight standardized aluminum units that were to be assembled at the site. Republic

14. Buckmanminster Fuller: Wichita House (1949) [223]

[221] Arieff and Burkhart, 23.
[222] Ibid, 23.
[223] Source http://www.wichitaphotos.org/searchresults.asp?txtinput=Residences&offset=100

Aircraft was set to produce it. Though the well-publicized house drew over 30,000 expressions of interest from around the country, Republic, in the end, manufactured only two.[224]

To make up for the decline in aircraft manufacturing after the war, many aircraft companies attempted to adapt their factories and technology for home manufacturing. Vultex Aircraft commissioned industrial designer Henry Dreyfus to do a prototype affordable house for production. Designed in collaboration with architect Edward Larrabee Barnes, the walls of the Dreyfus house consisted of single full-sized panels made from paper cores skinned with aluminum. Manufactured off-site, these panels were to be transported to the desired location and then erected. The project was funded by the federal government's Guarantee Market program, created to provide housing and employment for workers making the transition to a postwar economy. Several other aircraft companies were developing prototype homes in an effort to make up for the decline in airplane manufacturing after the war, but none ever went into production. [225]

In France, furniture designer Jean Prouvé was similarly concerned with avoiding the repetition and monotony characteristic of most mass-produced housing communities. When commissioned by the French government in 1950 to design a mass-produced housing scheme, Prouvé developed a plan that called for fourteen variations of two design types. Twenty-five units wore built and installed in Meudon, France. For this group of houses, Prouve had developed a jointed steel structure that could be erected without scaffolding-a technique that he had used on numerous occasions, most notably

[224] Arieff and Burkhart, 23.
[225] Ibid.

with his frequent collaborators Pierre Jeanneret and Charlotte Perriand, for housing, hospitals, and other buildings. Like many early prefab experiments, the Meudon houses, perhaps because of their modern aesthetic, were sold to the fairly well-off rather than the lower-income population for whom they were intended. Prouvé had successfully demonstrated that the houses could be produced on a large scale, but the French government chose not to adopt his design and no additional homes were produced.[227]

15. Jean Prouvé: The Meudon houses (1950-1952)[226]

Carl Koch, the founder of Techbuilt, developed a housing system that took advantage of prefabricated housing technology without sacrificing individuality. Eager to distance his product from the prevailing stigma of prefabricated housing, Koch stressed that the Techbuilt home was not a package, "but a system of converging components that the builder and owner complete at their discretion." Though it may have been a matter of semantics, Koch's wording was a savvy move and helped Techbuilt achieve a great deal of success in the fifties and sixties. Other emerging companies believed that houses produced wholly or partly by machines didn't need to look industrial (modern), and the resulting model homes offered were typically Tudor, Colonial, Cape Cod, or ranch style. These more traditional vernacular types set the standard for the majority of the factor

[226] Source http://www.gsd.harvard.edu/studios/s97/burns/images/prouve_lil.gif
[227] Arieff and Burkhart, 25.

built homes by companies like Silvercrest, Fleetwood, and Kaufman and Broad that followed.[228]

In Australia, for example, architect Harry Seidler was commissioned to design a prototype industrialized production house that was later built in conjunction with the Royal Australian Institute of Architects Convention in 1954. Constructed from locally available materials, the prefabricated sections, columns, and open web beams could be erected by four men in just one day. The house was displayed at Sydney Town Hall for the duration of the convention but was never actually built. Seidler's goal was extreme flexibility. Nearly any floor plan could be constructed with a system of panels he developed, in contrast to the "monotonous sameness" (as Seidler put it) of typical prefab houses. The house also featured a prefabricated bathroom. The mechanical parts of the kitchen and the laundry room were also conceived as one-piece packaged units. Seidler had been a student of Walter Gropius at Harvard, and his work was clearly influenced by his teacher's belief in the need for more economical (both in terms of cost and scale) housing. [229]

[228] Arieff and Burkhart, 30.
[229] Arieff and Burkhart, 25.

As far back as the turn of the 20th century, Frank Lloyd Wright had troubled himself with the challenge of creating affordable housing. Although Wright's best-known effort was his Usonian prefabricated houses, less well-known were some of his last prefabricated kit homes created in 1957 for Marshall Erdman, a design-savvy owner of a construction Company Marshall Erdman & Associates. A rarity in the bottom-line motivated building industry, Erdman, like developer Joseph Eichler, was open to trying out ideas that combined modern aesthetics with affordability. Wright persuaded Erdman that he could create affordable, well-designed prefabricated kit houses for $15,000, half the cost of Erdman's then-existing "U-Form – It" kit homes. Perhaps sensing the irresistible opportunity to market a line of affordable houses stamped with the brand name of America's best-known architect, Erdman took up Wright's offer.[231]

16. Frank Lloyd Wrightz; Joseph Mollica House, builder Marshall Erdman (1956) Erdman[230]

The first Erdman prefabs, as they were commonly called, were built in 1955 and based on three designs. The most interesting was Erdman Prefab Design #2, a compact light-filled prefab kit constructed in 1957 in Madison, Wisconsin. Its square shape contained a double-height living room flanked by a perpendicular wall of rectangular

[230] Source http://www.wrightinwisconsin.org/WrightAndLike/2005/Mollica.gif
[231] Ebong, 25.

wood-framed ribbon windows that bathed the house in natural light and made for an effective passive solar system. The windows also engaged with the surrounding greenery maintaining, even at the affordable end of the scale, Wright's organic, environmentally friendly principles. Standardized panels of mahogany lined the interior, and the roofline was capped with Wright's decorative molded blocks, which added visual texture and richness to the home.[232] The house arrived as a kit of parts complete with components from kitchen cabinets to windows and exterior walls everything needed to complete the house save for the foundation, heating and plumbing fixtures, electrical wiring, and paint, all of which the buyer had to supply. [233]

Despite the prestige and innovation Wright brought to the project, the Erdman prefab homes proved simply too expensive to produce and were never cost-effective enough to attract lower-income buyers. In the end, despite major publicity in architectural journals and newsweeklies like Time and Life, only eleven kits were sold. The average cost of an Erdman prefab in 1959 was $20,000 for materials and $35,000 for Construction. Although they were among the most beautiful and whole prefab kit houses of their day, the Wright houses in the end were simply not affordable enough. Erdman lost money on the venture and had to stop making the prefab kits by 1959.[234]

In the States, new housing systems took advantage of advances in science and technology from solar panels to space stations and applied them to shelter. Ray Kappa's Advanced Technology House was commissioned by NASA in the sixties with a primary

[232] Arieff and Burkhart, 25-26.
[233] Ebong, 30.
[234] Ibid.

goal of demonstrating technology transfer to housing. Integral to the Advanced Technology House was the concept of a modular unit that was usable in various horizontal and vertical configurations, transportable, adaptable to different climates and site limitations, and energy efficient. Kappe proposed a glass skin that could change from clear to opaque and provide insulation, and a power unit that could be disengaged to provide personal transportation, ideas that significantly influenced subsequent explorations into sustainable technology and modular building systems.[235]

17. Kisho Kurokawa: Nakagin Capsule Tower (1970)[236]

As new challenges faced housing in the sixties and seventies, architects developed new concepts to confront them. Japan became a fulcrum for innovative prefabrication in the sixties, most notably from the work of architect Kisho Kurokawa, who had his own particular brand of prefab known as ”capsule architecture.” Kurokawa's Nakagin Capsule Tower (1970) was an inner-city project that aimed to create sustainable living space in the heart of Tokyo. Contemporaries of Kurokawa-including Warren Chalk of the Archigram Group, who had begun using the word "capsule" in 1964, France's Paul Memon, and Yona Friedman were also exploring the notion of capsule architecture at this time, but the Nakagin tower was the world's first capsule architecture built for actual use.

[235] Arieff and Burkhart, 32-33.
[236] Source http://www.inhabitat.com/wp-content/uploads/capsuletower3.jpg

The Nakagin Capsule Tower was the architect's most successful realization of his volumetric architecture concepts and recognized the ideas of metabolism, exchangeability, recycle-ability as the prototype of sustainable architecture. The building takes on the challenge of the issue of whether mass production can express a diverse new quality. The Tower also strives to establish a space for the individual as a criticism to the Japan that modernized without undergoing any establishment of "self".[237]

The Nagakin Capsule Tower was originally designed as a Capsule Hotel to provide economical housing for businessmen working late in central Tokyo during the week. The 14-story high Tower has 140 capsules stacked at angles around a central core. Kurokawa developed the technology to install the capsule units into the concrete core with only 4 high-tension bolts, as well as making the units detachable and replaceable.

The one-man-room capsule, a modified (4 x 2.5 meter) shipping container, has a circular window, a built-in bed and bathroom unit, and is complete with TV, radio and alarm clock. The capsule interior was pre-assembled in a factory then hoisted by crane and fastened to the concrete core shaft.[238]

The scheme provided for the eventual replacement or removal of capsules over time, depending on the spatial needs of the tenants. The connection of units, for example, could transform a studio apartment into a two-bedroom unit to accommodate a growing family. "By creating spaces of autonomy and individual identity, this building symbolizes individual human existence in the urban landscape," Kurosawa explains,

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[237] Kisho Kurokawa architect & associates. "Nakagin Capsule Tower". http://www.kisho.co.jp/page.php/209.
[238] Arcspace. "Nakagin Capsule Tower".http://www.arcspace.com/architects/kurokawa/nakagin/nakagin.html.

"This is symbiosis between material and spirit." Kurokawa saw a lot of potential in volumetric architecture. This flexibility applied to factory manufactured components pointed the way toward a shift in prefab's practical applications. Kurokawa factored in the individual's needs within a standardized framework.[239]

Buckminster Fuller remained hard at work on unique dwellings, too. Back in 1954, he had patented the icosahedron (a twenty-sided polyhedron with each side made up of an equilateral triangle) principle, and by the early sixties, he began to build structures based on that principle. Fuller touted these structures, known as geodesic domes, as a break-through in building technology and firmly believed in their potential for mass production. Intrigued, the U.S. Information Agency commissioned Fuller to design the U.S. Pavilion at the World Expo in Montreal in 1967. Fuller presented the Expo Dome, a geodesic three-quarter sphere with a diameter of seventy-six meters and a height of sixty-one meters. "If industry was to take it on, there are things we could do in geodesic domes that are spectacular," Fuller wrote in 1971. But domes seemed to be favored by hippies and naturalists for the freedom and flexibility they promised. The building industry was far less enthusiastic. Though Fuller's geodesic

18. Buckminster Fuller: Buckminsterfullerene [240]

[239] Arieff and Burkhart, 34.
[240] Source http://www.diracdelta.co.uk/science/source/b/u/buckminsterfullerene/buckminster-001.jpg

dome was considered by many to be his masterpiece, the form never gained the acceptance he had hoped for.[241]

In a lecture in 1929, Buckminster Fuller was asked what prefabrication meant for architects. Didn't he see, one observer asked, that the mass production of houses might very well make the architect obsolete? Fuller disagreed. “The architect's efforts today are spent in the gratification of the individual client,” he responded. “His efforts of tomorrow, like those of the composer, the designer of fabrics, silver, glass and whatnot may be expanded for the enjoyment of vast numbers of unseen clients. Industrial production of housing, as contrasted with the present industrial production of raw materials and miscellaneous accessories, calls for more skill and a higher development of the design element, not its cessation.”[242] Fuller was right on the mark. There are today a host of architects and designers who continue to .be compelled to explore the possibilities of technologies currently available as well as those yet to be discovered. Hopefully, their work will help to alter the prevailing perception of prefab as low quality and poor design, and it is their work-in production (or poised to be), custom-built, and conceptual-that follows.[243]

[241] However, the "Buckminsterfullerene" family of molecules based on Fuller's geodesic structure that was discovered by scientists Kroto, Smalley, and Curl in 1985 did help that trio win the Nobel Prize in 1997.
[242] Arieff and Burkhart, 36.
[243] Ibid.

Fuller's Expo Dome wasn't the only curious structure at the Montreal Expo. Also on display was Moshie Safdie's Habitat Montreal. Safdie was only twenty-four at the time and had never built anything before. His concept for the experimental housing scheme was deceptively simple. One hundred fifty-eight houses were constructed from 354 modular units. Eighteen different types were created based on the single box measuring 17.5 x 38.5 x 10.5 inches. The "houses" were built one on top of the other so that the roof of one formed the garden of the next. Each concrete module was a standard-sized living unit with an individual roof terrace. But the construction and fabrication were far more complex than Safdie's design suggested. Poured concrete was simply too heavy a material for the design. The finished structure was safe but the process of constructing it had been quite dangerous. This, combined with the cost of using custom production-line tools and molds rather than standard-issue ones, sent the project into a budgetary stratosphere $22 mil1ion, which was almost double the amount originally allotted. "I'm convinced," Safdie observed in his book, Beyond Habitat, published in 1970, "that no one is going to be able to mass produce a house until the entire process is under a single corporate structure, and probably a single union, too. Yet

19. Moshe Safdie: Habitat Montreal (1967)[244]

[244] Sources http://wadias.in/site/arzan/blog/wp-content/habitat_67.jpg

factory-made and produced housing is the magic word being whispered as the key to salvation. Present practice," he continued, "is impossible." [245]

In 1967 Danish-born architect and furniture designer Jens Risom designed his holiday home as a prefabricated kit, easily transportable to its remote windy site at the northern end of Block Island, where winds sometimes reached 100 miles per hour. Beautifully crafted, the elegant kit cost all of $20,000 and included precut lumber sections, lighting fixtures, and kitchen and bath fixtures-quite a bargain by 1960s standards. The house's kit of numbered parts made it easy to erect on the remote island with few skilled laborers. Risom's finely crafted kit house is an example of the high-quality aesthetic values that modern architects held onto in a sea of cheaply made mass-produced prefabricated housing kits that sprouted up in housing developments.[246]

In Britain in the sixties, many of the country's most innovative architects devoted themselves to the task of creating affordable, well-designed mass housing that addressed emerging social concerns from the fight for civil rights to solutions to the energy crisis. Architect Richard Rogers 'developed the Zip-Up Enclosures in 1968, a series of inexpensive, low-maintenance shelters that offered a high degree of environmental control and a large range of design choices. The Zip-Up system of construction utilized a snug-seam joint from Alcoa and could be built in a matter of weeks using existing standard components, The home's lack of internal structure allowed maximum flexibility

[245] Arieff and Burkhart, 33.
[246] Ebong, 30.

for partitions-demountable components run on retractable castors-and allowed the house to be extended out or up by adding or removing panels.[247]

Rogers later developed a concept for an Autonomous House that would function as an artificial ecosystem, recycling its own water and waste, heating or cooling itself using natural energy, and generating its own power. The Autonomous House, which looked as if it was about to make a lunar landing, stood on adjustable legs that raised it above the ground and rested on strip footings that provided stability and minimized the building's impact on the site. "Man can change his lifestyle and home to conform to nature and therefore curb his traditional destruction of the natural world," Rogers explained in the project brief. "His activities can then merge into the ecological system and his architecture can become complementary, rather than parasitic toward natural resources." [248]

British architect Paul Rudolph learned from some of Safdie's missteps. He believed that Safdie's choice of building material was the problem, not the experimental nature of the design. In 1968, Rudolph addressed (at least on paper) the "weight" problem that had vexed Habitat in a commission for the Amalgamated Lithographers of America, a building that was to accommodate 4,050 prefabricated residential units built on 65 floors, with 13 floors of industrial space for the lithographers and printers, plazas, traffic-free streets, and parking for 2,100 cars. This was a dream project for Rudolph; better still, the lithographers were not deterred by his $280 million estimate. He was thrilled by the promise of prefabrication. "When we first started seriously to think about the prefab-

[247] Arieff and Burkhart, 30.
[248] Ibid, 30, 33.

ricated home, everybody jumped to the conclusion that it would lead to monotony. I say it offers us a way of building truly imaginative and exciting homes." Rudolph's dream building was scrapped, however, when it faced opposition from other unions and from local government. In 1971, Rudolph went on to design many prefab structures, including a modular housing complex known as Oriental Masonic Gardens in New Haven, Connecticut. Local building codes got in the way of the cost effectiveness of Rudolph's modular scheme; he had more success with corporate buildings like the Oaiei Headquarters building in Nagoya, Japan, commissioned by a real-estate developer who built and sold prefabricated houses.[249]

Israeli architect Zvi Hecker was equally fascinated with the stacking of components but opted to dispense with rectilinear forms altogether when he designed the Ramot Housing Complex in Jerusalem in 1974.[250] Polyhedric modules were used to form a cluster of 720 units, also known as the beehive. In Germany, the firm of Hubner-Forster-Hubner also developed a variation on the theme with octagonal capsules made of plastic rather than steel for their Casanova House built in 1975. Twenty-three prefabricated cells were installed in a cluster on the site of a former dump located just outside Stuttgart. Each unit was delivered to the site fully equipped with wiring, heating, plumbing, and even wallpaper and carpeting.[251]

Inspired by technological advances and challenged by social and economic realities, architects continued to push the boundaries of not just prefabricated houses but

[249] Ibid, 33.
[250] Ibid.
[251] Ibid, 16.

the idea of housing itself. Domes, yurts, earthships, and other unconventional (and prefabricated) structures had their moment but remained at the margins. Few discernible changes were made with regard to the design and manufacture of prefabricated housing in the latter of the twentieth century. But there are rumblings of some positive transformations as the twenty-first century gets started. Established home builders like Lindal Cedar Homes, and Acorn and Deck Houses, for example, have endeavored to expand the range of plans, materials, and vernacular styles available within their repertoire. Young architects and architecture students worldwide continue to be fascinated with the promise of well-designed, affordable housing, as their experiments with virtual, sustainable, mobile, and/or temporary shelters attest. Even designers of custom homes are recognizing the environmental and economic benefits of prefabricated systems. Although industrial designer Ron Arad is better known for his innovative chairs, tables, and modular storage units made from industrial materials like injection-molded plastic and aluminum, for example, he made use of boat-building technology to develop radical new forms and off-site prefabrication for his one-off Amiga House designed in 1999.[252]

Among other factory-made housing models, trailers were an increasingly popular affordable housing alternative from the 1920s onward. Initially mobile homes served the needs of practical, cost-conscious travelers who combined the desire to experience the great American outdoors with a ready-made place to stay. [253]

[252] Ibid, 36.
[253] Ibid, 17.

By the time, World war II loomed, mobile trailers began to be used for purposes other than travel. They became larger in size and where often used to house factory workers as well as temporary housing for veterans and their families. The mobile home's stationary status was symbolized by the familiar sight of the vehicle, with missing wheels, hoisted on a more permanent foundation of cement cinder blocks. The negative image that trailers have long endured often obscures their success in delivering cost-effective housing alternatives bolstered by a highly effective marketing and distribution system. While mobile homes leave a lot to be desired design-wise, their consumer-friendly marketing, distribution, and delivery systems may be a worthy model to explore for today's modern kit homes.[254]

Spartan Aircraft Company began to manufacture house trailers rather than conventional houses. Incorporating the structural technology of the airplane, the Tulsa, Oklahoma-based company manufactured house trailers that were constructed from aluminum sheets riveted to a ribcage-like frame (the "monocoque" design was first developed by William Hawley Bowlus in the early thirties). First manufactured in 1947, the Spartan trailer was the first trailer expressly designed as a house. Spartan enjoyed considerable success with its category-defying shelter. Unlike prefabricators and merchant builders whose projects were dependent on subsidized mortgage programs, Spartan's combination of mobility, affordability, and availability allowed the company to thrive.[255] Perhaps an alliance would have suited both parties, but for the most part, advocates of industrialized housing ignored the trailer industry. Throughout the

[254] Arieff and Burkhart, 17.
[255] Walls, Wheel Estate, 110-11.

industrialized world, individuals continued to push the boundaries of industrial production in architecture.[256]

In the 1950s and 1960s, some of the most imaginative modern kit houses were built as vacation homes. Easily broken down into precut, factory-made standardized parts, an entire home could be trans-homes[257]. Easily broken down into precut, factory-made standardized parts, an entire home could be transported in pieces on the back of a truck for quick assembly on-site with little more than a two-man team. The problems associated with planned communities probably paled in comparison to the assumed tawdriness of mobile-home parks that were opening at a rapid rate. This expansion was due in part to the introduction in 1954 of Marshfield Homes' "Ten-Wide," a mobile home that was two feet wider than the conventional eight-foot model common to the industry. Marshfield's Ten-Wide was popular because of the extra space and privacy it afforded, but it caused tremendous upheaval. It took up more room in the factory, which created production problems, as well as on the highway, leading many states to restrict its mobility. It ultimately forced the hand of trailer manufacturers, who had to choose between producing narrower models (recreational vehicles) or the wider ones (mobile homes). By 1963, these two industries split.[258]

Mobile homes were typically designed to look like either trailers or permanent homes, but a third aesthetic emerged briefly around the time the Ten-Wide was introduced. A small group of companies aiming to capitalize on the increasing popularity

[256] Arieff and Burkhart, 253.
[257] Ibid, 29.
[258] Ibid, 28.

of industrial design promoted the mobile home as an industrial product. Raymond Loewy-who had designed everything from the Avanti automobile to the logo for Lucky Strike cigarettes-was hired to develop a new line of mobile homes in the mid-fifties. In 1963, the Marlette Company commissioned an industrial-design firm in Chicago to develop prototypes that bore a striking resemblance to Mies van der Rohe's sleek modernist boxes. (The company reverted back to its more conventional styles within a year.) Even Frank Lloyd Wrights designs were tapped. National Homes commissioned Wright's Taliesin Studio to design a "Prairie-style" mobile home. The final version was used for display purposes but never built. The low cost of mobile homes attracted buyers more concerned with shelter than style, which helps to explain why the higher-end versions failed to go into production. The mobile-home industry quickly got over its infatuation with modernism and committed itself to the fetching "rectangular" vernacular. By 1960, homes on wheels would account for 15 percent of the nation's housing dollar, amounting to fully one-quarter of all single-family homes by 1968.[259]

Prefabricated, mobile, and manufactured housing companies proliferated in the fifties, and their goals were focused far more on financing than design. Fleetwood, which started off as a recreational-vehicle company, began creating "homes away from home" for an American public fascinated by their new ability to travel the United States by automobile, and went on to expand their scope to manufactured housing. As the market for housing stabilized, buyers were less desperate and could demand more freedom of choice and better quality. Prefab home builders suffered from those increased customer

[259] Ibid, 29.

expectations as a result. The rapid-fire construction that had taken place after the war resulted in many homes of substandard quality, and now the prefab industry had to answer for it. The industry looked for ways to enhance its maligned product, By developing new techniques, even new descriptive terms for their products, many companies attempted to distance themselves from prefabrication altogether. [260]

2. Construction Methods and Materials

Traditionally in North America, house-construction techniques include light-frame construction in areas with access to supplies of wood. In arid regions with scarce wood-resources, adobe or sometimes rammed-earth construction is used. Some areas use brick almost exclusively, and quarried stone has long provided walling. To some extent, aluminum and steel have displaced some traditional building materials.

Recent increasingly popular alternative construction materials include insulating concrete forms (foam forms filled with concrete), structural insulated panels (foam panels faced with oriented strand board or fiber cement), and light-gauge steel framing and heavy-gauge steel framing. These newer prefabricated products provide labor savings, more consistent quality, and possibly accelerated construction processes. Today housing methods are generally categorized in two types: I. On-site Construction and II. Prefabricated construction (or factory-built home).

[260] Arieff and Burkhart, 29-30.

A. On-site Construction/ Site-built Home

On-site construction, also known as a stick-built home, is one constructed entirely or largely on-site; that is, built on the site which it is intended to occupy upon its completion rather than in a factory or similar facility. This term is used to contrast such a dwelling with mobile homes, modular homes and manufactured home that are assembled in a factory and transported to the site entirely or mostly complete. Hence these are not "stick-built." Homes that are custom-designed or built according to stock plans are considered stick-built so long as they are constructed on-site.[261] Most of a custom built home, which is especially designed to meet the specifications of the person who commissioned it, is on-site construction.

As a comparison to a custom home, stock building plans are *not* custom designed; the same plan may be sold to many different people. Frequently a builder will customize stock plans by changing details. The builder may change the type of siding, move a doorway, or even add a dormer. However, the house is not truly a custom home unless a designer, such as an architect, has closely studied the land and interviewed the clients to create a one-of-a-kind home that is tailor-made for the people who will live there. In other words, in order to build a custom home, the home owner will need a building site and an architect or a professional home designer. A builder who specializes in custom homes may also offer design services.[262]

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[261] Wikipedia contributors. "Stick-built." Wikipedia, The Free Encyclopedia. http://en.wikipedia.org/wiki/Stick-built (accessed June 2, 2007).
[262] Jackie Craven, "Custom Home," New York; About, Inc., The New York Times Company, 2007, http://architecture.about.com/cs/buildyourhouse/g/customhome.htm (accessed June 20, 2007.

Another type of on-site construction is a home built by a production home builder who builds houses, townhouses, condos, and rental properties on land that is owned by the building firm. Using stock plans, the production home builder will construct a large number of buildings each year. Often homes may be customized by selecting a variety of options, but the homes are not truly Custom Homes. Production Home Builders do not generally undertake construction of unique, architect-designed custom homes. Also, Production Home Builders will not usually use construction plans other than the ones selected by the building firm. Suburban housing subdivisions are good examples of Production Home Builders' products.

Framing, known as light frame construction, is today's most common construction method for stick-built homes, and is a building technique based around structural members, usually called studs, which provide a stable frame to which interior and exterior wall coverings are attached, and are covered by a roof comprising horizontal joists or sloping rafters covered by various sheathing materials. Modern light-frame structures usually gain strength from rigid panels used to form all or part of the wall sections, but until recently carpenters employed various forms of diagonal bracing to stabilize walls. Diagonal bracing remains a vital interior part of many roof systems. Light frame construction has become the dominant construction method in North America and Australia because of it is economical. Use of minimal structural materials allows builders to enclose a large area with minimal cost, while achieving a wide variety

of architectural styles. The ubiquitous "platform framing" and the older "balloon framing" are the two different light frame construction systems used in North America.[263]

B. Prefabricated Construction / Factory-Built Home

A prefabricated home is a house manufactured off-site in advance, usually in standard sections that can be easily shipped and assembled. Prefabricated home have not been particularly marketable; possible reasons for this include:

- Homes are not currently produced cost effectively enough for current demand.
- Homes are not considered a realistic housing solution by the average consumer.
- The consumer is either not familiar with the concept, or does not desire it.

The prefabricated construction method includes a modular home, a manufactured home, a panelized home and a mobile home.

1) Modular Home

Modular homes are houses that are divided into multiple modules or sections which are manufactured in a remote facility and then delivered to their intended site of use. A crane then assembles the modules into a single residential building. A modular home is constructed of pre-made parts and unit modules such as wall panels, trusses, and

[263] Jackie Craven, "Production Home Builder," New York; About, Inc.,The New York Times Company, 2007. http://architecture.about.com/cs/buildyourhouse/g/production.htm (accessed June 20, 2007).

other house parts. A complete kitchen and bath may be pre-set in the house. Modular components are typically constructed within a large indoor facility on assembly lines much like Henry Ford originally instituted with his automobile company, where they are never subjected to adverse weather conditions. The sections move through the factory, using an assembly line track to move the modules from one workstation to the next. The company's quality control department checks them after every step. Independent building inspectors are on site to supervise the construction and ensure that all building codes are adhered to during assembly. Finished modules are covered for protection, and then transported on a flatbed truck from the factory to the building site.

A modular home is factory-built; it does not rest on a steel chassis as the manufactured home. It is hauled by two separate trucks and each frame needs five or more axles, depending on the size of the house. Once the house has reached its location the axles and the tongue of the frame are then removed, and the house is set on a concrete foundation by a large crane. It is assembled on a fixed foundation a fixed foundation and floor framing. At the building site, these house sections are lifted onto the pre-made foundation, joined, and completed by a local builder. Modular buildings can be assembled on top of multiple foundation surfaces, such as a crawl space, stilts (for areas that are prone to flooding), full basements or std. slab on grade. They can also be built to multi-story heights. Motels and other multi-family structures have been built using modular construction techniques. Exterior wall surfaces can be finalized in the plant production process or in the case of brick/stone veneers field applications may be the

builder's choice. Roof systems also can be a part of - separate from - applied in the field after the basic installation is completed.

The placement of the modules together generally takes several hours or days. Once assembled, modular buildings are permanently anchored and essentially indistinguishable from typical site-built homes. While a mobile home and a manufactured home often decrease in value over time, a well-built modular should have the same longevity as its site-built counterpart, increasing in value over time. The length of the construction depends on design and the manufacturer, but some modular homes can be built in the factory in as little as 1-2 weeks but generally take one to three months to be constructed.. And since modules are built indoors, there's never a weather delay. It usually takes another 2-4 weeks for a local builder to complete the home once it's delivered to the building site.

Today's Modular homes come in many shapes and styles, and often do not resemble a typical single or doublewide mobile home. Without knowing, it is almost unrecognizable. Modular home manufacturers use computer aided design programs to draw plans to required specifications, or to modify one of their standard plans to suit homeowner's needs, so nearly any home plan can be turned into a modular home. It's true that some modules are very basic and resemble double wide manufactured homes, but the two structures are still built in different ways.

For financial processing most banks, appraisers, and insurance companies treat modular homes the same way they do for on-site construction homes. Typically construction costs for a modular home are sometimes less per square foot than for a

similar on-site construction home and is typically more cost-effective to builders and consumers. These new homes can be constructed in less time then it takes to build a home “on-site”. There are other cost-saving features: such as energy efficiency, which helps reduce your heating and cooling costs, and shorter construction periods rather than on-site constructions.

Manufacturers cite the following reasons for the typically lower cost/price of a modular home

- Indoor construction. Assembly is independent of weather which increases work efficiency and avoids damaged building material.
- Favorable pricing from suppliers. Large-scale manufacturers can effectively bargain with suppliers for discounts on materials.
- Low waste. With the same plans being constantly built, the manufacturer has records of exactly what quantities of materials are needed for a given job. While waste from a site-built dwelling may typically fill several large dumpsters, waste from a modular dwelling generates much less waste.

Modular homes are generally designed to be initially stronger than site-built homes, for example, by replacing nails with screws and adding glue to joints. This is to help the modules maintain their structural integrity as they are transported on trucks over major highways to the construction site. Despite the modular home being initially built to be stronger than a stick built home, it is hard to predict the final building strength since it needs to endure transportation stresses that site-built homes never experience.

Typically, modular dwellings of the US are built to local code, so dwellings built in a given manufacturing facility will have differing construction standards depending on the final destination of the modules. Steel and/or wood framing are common options for building a modular homes. Modular home designs can be customized for local zoning codes. Some housing subdivisions prohibit modular homes.

Some US courts have ruled that zoning restrictions applicable to mobile homes do not apply to modular homes since modular homes are often assembled with a permanent foundation. Additionally, in the US, the Uniform Standards of Professional Appraisal Practice allow site-built homes to be used as comparators to modular homes in real estate appraisal; thus, modular homes can in some cities and counties (depending on local ordinances) be evaluated the same way as traditionally built dwellings of similar quality. Possible developments in equivalence between modular and site-built housing types for the purposes of real estate appraisals, financing and zoning may increase the sales of modular homes over time.

Some home buyers and some lending institutions resist consideration of modular homes as equivalent in value to site-built homes. While the homes themselves may be of equivalent quality, entrenched zoning regulations and psychological marketplace factors may create hurdles for buyers or builders of modular homes and should be considered as part of the decision-making process when exploring this type of home as a living and/or investment option. [264] [265] [266]

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[264] Janet Wickell, "What Is a Modular Home? ," New York; About, Inc. 2007, http://homebuying.about.com/cs/modulareducation/a/modularhomes.htm (accessed June 20,2007).
[265] Craven, Jackie. "Modular Home," New York; About, Inc. The New York Times Company, 2007. http://architecture.about.com/cs/buildyourhouse/g/modular.htm (accessed June 20, 2007).

2) Manufactured Home

A manufactured home is often confused with, but is not identical to, modular homes. A manufactured home is placed on a steel chassis and transported to the building site. The wheels can be removed but the chassis stays. On the other hand, a modular home is transported on a flatbed truck rather than being towed, and lacks axles and an automotive-type frame typical of a manufactured home. A manufactured home is also confused with, but is not identical to, a mobile home.

The term "manufactured home" specifically refers to a home built entirely in a protected environment under a federal code set by the US Department of Housing and Urban Development (HUD). Today, a manufactured home is not a mobile home. The term "mobile home" describes factory-built homes produced prior to the 1976 HUD Code enactment. In the other word, all manufactured homes are produced after 1976.

Manufactured housing is a type of housing unit that is largely assembled in factories and then transported to sites of use. The original focus of this form of housing was its mobility. Units were initially marketed primarily to people whose lifestyle required mobility. However, beginning in the 1950s, mobile homes began to be marketed primarily as an inexpensive form of housing designed to be set up and left in a location for long periods of time, or even permanently installed with a masonry foundation.

Previously, units had been eight feet or less in width, but in 1956, the introduction of the 10-foot wide mobile home was made. This helped solidify the line between mobile

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[266] Wikipedia contributors. "Modular home." Wikipedia, The Free Encyclopedia. http://en.wikipedia.org/wiki/Modular_home (accessed June 2, 2007).

homes and house/travel trailers, since the smaller units could be moved simply with an automobile, but the larger, wider units required the services of a professional trucking company. In the 1960s and ‘70s, mobile homes became even longer and wider, making the mobility of the units more difficult. Today, when a manufactured home is moved to a location, it is usually kept there permanently. Since the 1970s, the term “manufactured home” has largely replaced “mobile home,” since the mobility of the units has considerably decreased.

Unfortunately the manufactured homes of the past developed a negative stereotype because of their lower cost and the tendency for their value to depreciate more quickly than site-built homes. The tendency of these homes to rapidly depreciate in resale value made using them as collateral for loans far riskier than traditional home loans. Terms were usually limited to less than the thirty year term typical of the general home-loan market, and interest rates were considerably higher. In other words, mobile home loans resembled motor vehicle loans far more than traditional home mortgages. They have been consistently linked to lower-income families, which has led to prejudice and zoning restrictions, which include: limitations on the number and density of manufactured homes permitted on any given site, minimum size requirements, limitations on exterior colors and finishes, and foundation mandates. There are many jurisdictions that will not allow the placement of any additional manufactured homes, while others have strongly limited or forbidden all single-wide models, which tend to depreciate in value more rapidly than modern double-wide models.

The derogatory concept of a "trailer park" is typically older mobile homes occupying small, rented lots and remaining on wheels, even if the home stays in one place for decades. However a modern manufactured home belies this image and can be identical in appearance to an on-site built home. Newer manufactured homes, particularly double-wides, tend to be built with much higher standards than their predecessors and meet the building codes applicable to most areas. This has led to a reduction in the rate of value depreciation of most used units.

As the legal differentiation between a modular home and manufacture home becomes more codified, the market for modular homes is likely to grow. However, the manufactured home industry would also seem to have a bright future as well. As the demand for housing continues to grow, the price of housing continues to increase rapidly. The constant improvement of quality and features of manufactured homes has led to greater acceptance by a growing segment of the marketplace. Additionally, insurers and lenders are now more likely to treat the higher-end manufactured home as they would a traditional home. [267] [268]

3) Mobile Home

Mobile homes are housing units built in factories, rather than on site, and then taken to the place where they will be occupied. They are usually transported by tractor-trailers over public highways. They are less expensive per square foot than site-built

[267]Jackie Craven, "Manufactured Home," New York; About, Inc. The New York Times Company, 2007 http://architecture.about.com/cs/buildyourhouse/g/prefabricated.htm,
[268]Wikipedia, the free encyclopedia, "Manufactured housing," Wikimedia Foundation, Inc. http://en.wikipedia.org/wiki/Manufactured_housing.

homes, and are often associated with rural areas and high-density developments, sometimes referred to as trailer parks. In the United States they are at times referred to as "mobile home parks".

As mentioned in the manufactured home section, the term of the mobile home is a type of manufactured home produced prior to 1976. Mobile homes are usually placed in one location, often a rented lot, and left there permanently. However, they do retain the ability to be moved, as this is a requirement in many areas. Behind the cosmetic work fitted at installation to hide the base, there are strong trailer frames, axles, wheels and tow-hitches.

The two major forms of manufactured homes are single-wides and double-wides. Single-wides are sixteen feet or less in width and can be towed to their site as a single unit. Double-wides are twenty feet or more wide and are towed to their site in two separate units, which are then joined together. Triple-wides and even homes with four, five, or more units are also manufactured, although not as commonly.

In the U.S., manufactured homes are regulated by the United States Department of Housing and Urban Development (HUD), via the Federal National Manufactured Housing Construction and Safety Standards Act of 1974. It is this national regulation that has allowed many manufacturers to distribute nationwide, since they are immune to the jurisdiction of local building authorities.

This development of mobile home goes back to the early years of automobiles and motorized highway travel. It was derived from the travel trailer, a small unit with

permanently attached wheels often used for camping. Larger units intended to be used as dwellings for several months or more in one location came to be known as house trailers.

Eventually many people who could not afford a traditional site-built home or did not desire to commit to spending a large sum of money on housing began to see manufactured homes as a viable alternative for long-term housing needs. The units were often marketed as an alternative to the apartment rental.

In the past, manufactured home parks also known as a trailer park and mobile home park, have, often with legitimate reason, been thought of as substandard. With more modern manufactured home parks however, this is not the case. Most have regulations concerning the size and styles of homes permitted, and many are somewhat similar to more traditional subdivision developments. In some of the more satisfactory parks, all of the homes are owned by the individual occupants. Only the spaces or pads are rented, not the units themselves. Developments in which the buyer purchases both the home and the lot are almost indistinguishable from traditional subdivisions. In lower-end parks, some or all of the units are owned by the operators of the park and are rented to occupants. These developments are considered undesirable by property owners because they are known to depreciate the value of surrounding property.

In the American Midwest, manufactured homes are sometimes facetiously referred to as “Tornado Magnets” or “Tornado Bait” due to the perception that tornadoes strike them more frequently than other structures. Tornadoes do not actually strike manufactured homes any more or less frequently than any other type of structure. However, while an F1 tornado might cause minor damage to a site-built home, it could

do significant damage to a manufactured home, especially an older model or one that is not properly secured. Many brands offer optional hurricane straps, which can be used to tie the manufactured home to anchors embedded in the ground. This gives the owner substantial protection against heavy winds.[269]

4) Prefab

Recently, modern architects are experimenting more often with prefabrication as a means to deliver well-designed and mass-produced modern homes. Modern architecture forgoes referential decoration and instead features clean lines and open floor plans. Because of this, many feel modern architecture is better suited to benefit from prefabrication.

The word “Prefab”, sometime called a kit house, is not an industry term like modular home, manufactured home, panelized home, or on-site construction. The term is an amalgamation of panelized and modular building systems, and can mean either one. In today's usage the term “Prefab” is more closely related to the style of home, usually modernist, rather than to a particular method of home construction.

A prefab component can be used in a quick, easy and fast installation of any structure like a house, home, storage, cabin or garage. Prefab components are becoming popular to construct any building structure as they are cheap, fast to build and durable. The prefab home or house requires much less labor as compared to conventional houses or homes.

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[269] Wikipedia contributors. "mobile home,” Wikipedia, The Free Encyclopedia. http://en.wikipedia.org/wiki/Mobile_home (accessed June 2, 2007).

Prefab homes are becoming popular in Europe, Canada and United States as they are cheap and durable.[270] Although there are hybrid projects that incorporate more than one building system into the design, there are generally three types of construction systems for prefab projects; 1 modular, 2 post-and-beam frames, and 3 panelized building systems. The benefits of each method of construction are explored below.

i) Modular system

The Modular system offers the most integrated form of housing construction available. Instead of hundreds of separate parts put together on-site, methods of modular construction make it possible for parts to be put together in a factory. Parts of the kit are more likely to arrive in huge chunks-whole walls and roof sections, even bathrooms and kitchen modules that can be "plugged-in" within the confines of the factory. The entire outer shell of a home is often produced entirely indoors and often come prewired with plumbing preinstalled. The partially or fully constructed exterior shell can be shipped to the work site or as a complete shell and lowered onto the permanent foundation by crane. Often whole exteriors or outer housing shells can be erected in as little as a day, allowing interior finishing taking place as a do-it-yourself project or using professional builders.

ii) Post-and-Beam Precut System

The Post-and-Beam Precut System has more parts than Modular versions and tends to be more expensive to build because, quite simply, with many more parts they

[270] Wikipedia contributors. "Prefabricated home." Wikipedia, The Free Encyclopedia. http://en.wikipedia.org/wiki/Prefabricated_home (accessed June 2, 2007).

require more labor and management on-site. Precut homes, though, do offer more variety in terms of construction styles, from A-frames to pole systems. Precut kits are also more easily transportable in smaller containers, and can be shipped with greater ease to far away destinations.

iii) Panelized System Home

The Panelized System is becoming increasingly popular in home building. Not only are they sturdy, but also they provide excellent insulation. There are generally two types of panels: open and closed, Open panels do not have any insulation or finishing material attached and are often comprised of just a single exterior sheathing, leaving the interior wall exposed. Closed panels are both insulated and finished on the inside, Structural insulated panels (SIPs) are closed panels more completely finished and are made up of foam sandwiched between two sheets of oriented strand board.

The advantages of each system are as follows;

a) Modular system:

- Because the modular systems are built indoors at a factory, they are less subject to weather delays and are subject to factory inspections and quality control. They are faster and cheaper than conventional buildings, which are subject to the vagaries of weather. Since they are constructed essentially in a factory and trucked to the site, they require less on-site labor.

- When the building site is an urban or suburban lot, the factory-made exterior shell can often be lowered quickly and efficiently on-site.
- For small lots, modular homes allow for vertical expansion. Modules can be added to the existing structure later, as the family expands or more space is needed. In situations where the environment is fragile and a small footprint is required, modular building methods offer a relatively unobtrusive way of environmentally controlled construction.
- Because they have to be transported to their destination, modular homes are often constructed to be stronger and sturdier than conventional homes. Joints are often nailed and glued for extra measure.
- For do-it-yourself homebuilders, modular housing offers a less formidable challenge, since the outer shell of the house arrives intact with wiring and plumbing preinstalled and placed on-site for you.

b) Post-and-Beam Precut System:

- Precut systems with post-and-beam construction methods, which structurally support expansive interior spaces, make airy, open, and light-filled rooms.
- Post-and-beam precut system can support huge glass window walls with bucolic views, and are perfect for large plots of land.
- Lumber used in precut homes are of the highest quality comprising of kiln-dried timbers, which settle well without warping or shrinking.

- Precut homes use several different systems of construction and therefore offer greater flexibility in terms of design. Difficult and complex spatial requirements are often easier to incorporate.

c) Panelized System:

- Panelized homes are extremely energy efficient and provide superior insulation.
- The exterior shell of panelized kits can be assembled in days, allowing interior work to proceed even while other parts of the house are being finished.
- Quick assembly saves time and money.

Panelized kits allow for more flexible floor plans and custom design input compared to modular homes[271]

3. Structural Insulated Panel

Structural Insulated Panel systems (SIPs) are high performance building panels used in floors, walls, and roofs for residential and light commercial buildings. The panels are made by sandwiching a core of rigid foam plastic insulation between two structural skins of oriented strand board (OSB), Typical foam cores are made of expanded polystyrene (EPS), extruded polystyrene (XPS) or rigid polyurethane foam, however, other materials can be used for specific purposes such as wheat straw and agricultural fiber for the core, and fiber-cement or plywood for skin.

[271] Ebong, 148, 150-151.

A. Development of SIP

Forest Products Laboratory (FPL) in Madision, Wisconsin, did the primary research and testing of the SIP technology as part of the U.S. Forest Service's attempts to conserve forest resources. A small stressed-skin house was constructed in 1937 and dedicated by First Lady Eleanor Roosevelt. The house has endured the severe Wisconsin climate and is now being used as a day care center by the University of Wisconsin-Madison. Because of its success, it was suggested that stronger skins could take the entire structural load and eliminate the frame altogether.

Thus in 1947, structural insulated panel development began with corrugated paperboard cores and were tested with various skin materials of plywood, tempered hardboard and treated paperboard. The building was dismantled in 1978 and most of the panels retained their original strength with the exception of paperboard which is unsuited to outdoor exposure. Panels consisting of polystyrene core and paper overlaid with plywood skins were used in a building in 1967 and the panels have performed well to the present day.

Then in the early 1980s H.H. "Hoot" Haddock, a former construction manager for the Alaska pipeline, began research on a cement-skinned panel system called ThermaSAVE[272] to withstand the harsh Alaskan climate.

[272] ThermaSAVE is a 4 to 12-inch-thick core of expanded polystyrene sandwiched between two sheets of cellulose fiber-reinforced cement board, varying in thickness from 3/8 to 7/16 inch, depending on structural requirements. Because of its durability and construction efficiency in both time and cost, it is considered to be could be implemented in Iran, Afghanistan and even in areas effected by the 2004 Indian Ocean tsunami by 2006. Referenced Wikipedia contributors. "ThermaSAVE," Wikipedia, The Free Encyclopedia. http://en.wikipedia.org/wiki/ ThermaSAVE (accessed June 2, 2007).

B. Advantages and drawbacks

SIPs are manufactured under factory controlled conditions and can be custom designed for each residential construction. Today the use of SIPs brings superior advantages and fewer drawbacks when compared to a conventional stick framed building.

SIPs share the same structural properties as an I-beam or I-column. The rigid insulation core of the SIP performs as a web, while the OSB sheathing exhibits the same properties as the flanges. SIP plays its role as several components of conventional building, such as studs and joists, insulation, vapor barrier and air barrier.

Due to the standardized and all-in-one nature of SIPs, construction time can be reduced over building a stick frame home as well as requiring fewer trades for system integration, such as wall, roof, floor and foundation systems. Using SIPs for floors are particular benefit when used above an uninsulated space below.

Because SIPs work as framing, insulation, and exterior sheathing, and arrive to the jobsite as a precut condition from the factory, the amount of additional framing required is minimal such as window openings, electrical chases, and a separate header may not need to be installed. The construction processes for the exterior building envelope go up faster than traditionally framed buildings and save a significant amount of time during the construction.

SIPs are always straight and true, and there are far fewer callbacks, no culling studs, or need to straighten walls. SIPs also provide a uniform nailing surface for both interior and exterior finishing. This process significantly reduces jobsite waste disposal, temporary heat and landfill during construction. It will reduce construction cost lower.

Factory fabrication is often done using optimization software and many manufacturers recycle factory scrap to make other foam products.

A well built home using SIPs will have a tighter building envelope and the walls will have a higher R-value: the efficiency of insulation or thermal resistance, which leads to fewer drafts and a decrease in operating costs for maintaining a comfortable interior environment for the homeowners.

SIPs are one of the most environmentally responsible building systems available. A SIP building envelope provides high levels of insulation and is extremely airtight; meaning the amount of energy used to heat and cool a home can be cut by up to 50 percent, plus it may possibility qualify for Energy Efficient Mortgages, and rates higher appraised value for homeowner.

The energy that powers homes and commercial buildings is responsible for a large portion of greenhouse gasses emitted into the atmosphere. By reducing the amount of energy used in buildings, architects, builders, and homeowners can contribute to a clean environment for the future.

The insulation used in SIPs is a lightweight rigid foam plastic (EPS foam) composed of 98% air, and requires only a small amount of petroleum to produce.

The foam insulation used in panel cores is made using a non-CFC blowing agent that does not threaten the earth's ozone layer. In addition, it is a non-toxic hydrocarbon and burning it results only in water vapor, carbon dioxide and trace levels of ash, similar to paper.

The EPS insulation is a closed cell insulation as compared to fiberglass insulation which is an open cell insulation. Both insulations R-values are tested in a laboratory under steady state conditions where there is no air infiltration. When a SIP is installed as a wall, foundation, floor or roof system, the EPS is installed in a steady state environment, where as fiberglass insulations are installed in a non-steady state environment because these wall, foundation, floor and roof systems have to be vented to remove moisture. Many research studies show that the R-values of fiberglass insulation decrease as the temperature differential of indoor and outdoor temperatures increase resulting in higher energy costs to the homeowner.

The high insulating properties and building tightness capable with SIPs allow HVAC equipment to be downsized. The tightness of the SIP building envelope also prevents air from gaining access to the interior of the home and requires mechanical ventilation. By limiting air exchange to controlled ventilation systems, SIP homes allow for all incoming air to be filtered for allergens and dehumidified for less prone to mold growth and dust mites. A controlled indoor environment is both healthy and comfortable environment for homeowner. As a result, this building system is extremely strong, energy efficient and cost effective.

C. Dimensions and characteristics

In the United States, SIPs tend to come in sizes from 4 feet (1.22 meter) to 24 feet (7.32 meter) in width. Elsewhere, typical product dimensions are 300, 600, or 1200 mm wide and 2.4, 2.7 and 3 meter long, with roof SIPs up to 6 meter long. Smaller sections

ease transportation and handling, but the use of the largest panel possible will create the best insulated building. At 15−20 kg/m², longer panels can become difficult to work with without the use of a crane to position them, and this is a consideration that must be taken into account due to cost and site limitations. Also of note is that when needed for special circumstances longer spans can often be requested, such as for a long roof span. Typical U.S. height for panels is eight or nine feet (or 2.44 to 2.75 meter). Wall panels tend to come in 4.5–6.5 inches (or 125–200 mm) thicknesses, but can be made up to 1 ft (or 300 mm) for roofs. [273]

EPS is the most common of the foams used and has an R-value of about 4 K·m²/W per 25 mm thickness, which would give the 3.5 inches of foam in a 4.5 inch thick panel an R value of 13.8. This at face value appears to be comparable to an R-13 batt of fiberglass, but due to the fact that in a standard stick frame house there is significantly more wall containing low R value wood that acts as a cold bridge, the thermal performance of the R-13.8 SIP wall will be considerably better.

[273] Wikipedia contributors. "Structural insulated panel." Wikipedia, The Free Encyclopedia. http://en.wikipedia.org/wiki/ Structural insulated panel (accessed June 2, 2007).

SECTION D
SITE AND CONTEXT

1. Site Information

This site project is located in Novi, a suburb of Detroit, Michigan. The parcel is a 3.05 acre rectangular lot, approximately, 305 feet by 436 feet.

Currently the parcel is zoned R-4, Single Family Residential, however, a petition has been submitted to rezone the parcel to Multifamily Residential to accommodate a condominium development. It is expected that the new zoning will be adopted upon the completion of the lot purchase transaction.

Characteristics of the Site

The parcel address is 205 New Court although currently there is no access to the site from New Court. The parcel is bounded on the east by an 80 foot wide parcel of wooded area currently owned by the Hickory Woods Elementary School, bounded on the North by the Hickory Woods Elementary School, on the South by a Wetland Nature Preservation Area, and on the West by Novi Road (four lanes) which is a relatively busy street. Currently a petition has been submitted to change the proposed access to the site from New Court to Novi Road. The site is entirely covered with mature trees except for one abandoned shed structure. The topography is relatively smooth and flat.

Climate of Area

Novi, including Detroit and the rest of southeastern Michigan, has a continental climate which is influenced by the Great Lakes. Winters are cold with moderate snowfall and nighttime temperatures sometimes dropping below 10 °F, while summers are warm with temperatures sometimes exceeding 90 °F. Average monthly precipitation ranges from about two to four inches. Snowfall, which typically occurs from November to early April, ranges from an average of 1 to 10 inches a month.

D. Arch. Project Site Proposal

For this assignment, I would like to propose RT, Two-Family Residential zoning so the proposed dwelling structures can, in the future, be divided into two units if needed by the homeowners. The regulations for the RT, Two-Family Residential Zoning would be the same schedule adopted for R-4 zoning, as follows:

Schedule of regulations for R-4 zoning[274]

Minimum lot size per dwelling structure:	10,000 sq ft.
Minimum lot width in feet:	80 feet
Maximum height of structures:	2 ½ Stories
Maximum height of structures:	35 feet
Minimum front yard setback:	30 feet
Minimum rear yard setback:	35 feet

[274] Adopted, City of Novi, ARTICLE 24. SCHEDULE OF REGULATIONS. Sec. 2400. Schedule limiting height, bulk, density and area by zoning district

Minimum side yards setback:	10 feet
Minimum aggregate of two side yards:	25 feet
Minimum floor area per unit:	1000 sq. ft.
Maximum percentage of lot area covered:	25%

Once the petition is accepted, New Court would remain a cul-de-sac, and the project street, which will also be a cul-de-sac, will be entered off of Novi Rd. In order to provide sufficient turn around space for the project, the proposal requires that the 80 foot wide parcel of wooded area currently owned by the Hickory Woods Elementary School be purchased. Another option would be to request authorization from the school to convert that piece of property into a Nature Preservation Area in exchange for the use of a section for a cul-de-sac.

The proposal also reserves a 15 foot strip of land on the east side of the property be between the first dwelling structures and Novi Road for a sound buffer and privacy. I would also propose to preserve as many trees as possible that are located on the site.

2. Construction Methods

Recent prefabricated housing construction methods have exceptional strength and energy-efficient characteristics. By applying this recent technology, prefabricated housing is suitable for extreme snow, wind and even seismic loads with little or no additional material and/or engineering costs. Although in architectural design, site and its

context are extremely important elements, recent technology makes it possible to design an “almost all climate adaptable” design.

For this design project, an analysis had to be made of the benefits and disadvantages of site-specific/site-built and pre-fabrication methods.

An advantage of building on site is, in addition to the custom design of the house interior finishes, the overall plan and elevations to maximize its site views, reflect the site topography, protect existing vegetation and reduce the cost of site development. The ultimate expression of custom home building is stacks of raw lumber, metal sheets and masonry at a job site with a team of skilled artisans.

On the other hand the ultimate expression of pre-fabrication is building that same home in a factory and delivering it to the job site ready for move-in.

Both methods (site-built and pre-fabrication) have distinct benefits and both are often used together in home construction. Every building component made in a factory is an example of pre-fabrication. To meet building codes, even homes thought of as site-built are usually comprised of 90% pre-fabricated parts.

Lumber itself is partially pre-fabricated into standard dimensions. Home construction has inexorably moved toward greater degrees of pre-fabrication as part of the industrial movement of the past century.

Because the cost and methods of site construction are so high and inconsistent, people increasingly like the idea of building entire homes inside the factory. But where does pre-fabrication cross the line and become less efficient and more costly? For any homebuilder who wants design variations or for unique site conditions or locations, there

will always be an optimal line between pre-fabrication and site-based construction. That line is different for every project. Understanding where that line lies for a project will help in choosing a building process wisely.

A. The primary benefits of pre-fabrication

- The product is easier to control for output regularity (less variation from part to part, home to home) and for precision (larger, more expensive machinery and systematic methods can be used to achieve greater accuracy). Pre-fabrication does not, however, mean better quality.
- Factory labor cost is lower than skilled field labor costs and factory machinery and methods can reduce overall labor. Pre-fabrication does not, however, always mean lower cost.
- The product can have greater complexity (such as with electronic and mechanical components). Pre-fabrication does not, however, mean those complex parts will fit together into a better home. Better homes require both better design and better components.

B. The primary benefits of site-based construction

- The product can be altered and fashioned to accommodate the unique site conditions. A foundation is an obvious example.
- The product can be built where it will be used and avoid the cost of transporting it. The bigger or heavier the item, the more this axiom holds true.

- There is comparatively little cost to adapt production to accommodate customization. Factories are good at producing one thing efficiently, but can be more expensive producing unique items.

The goal of the project is to balance between the efficiency benefits of pre-fabrication and the flexibility benefits of site-built construction. By using pre-fabricated components for the house it makes it possible to achieve economy, precision, and other benefits of factory production.

There are a few considerations for pre-fabricating large assemblies:

1. If the factory process will dictate the architectural design instead of the architectural design dictating the construction, or
2. If pre-fabricated assemblies get so large that they will cost more to move than the savings.

There are other considerations to avoiding pre-fabrication of large assemblies such as building inspections and construction financing, which place special burdens and conditions when entire homes or sections are pre-fabricated.

Homes built in a factory incur high transport costs. The smallest of homes are generally bigger than the largest of roads. Chopping a home into transportable chunks forces the architecture to accommodate the move. Shipping parts and components that fit on common carrier trucks is comparatively inexpensive. A factory home can cost $20,000

to $60,000 to move and still require several days in the field to place and assemble on the foundation.

SECTION E
PROGRAM

The goal of this project is to demonstrate the following:

1. Housing plans which promote an adaptable home, designed and constructed to easily adjust to the evolving lifestyles of the homeowner.
2. A Prefab housing plan utilizing the latest advanced technology of the Structural Insulated Panel System which promotes sustainable design.
3. Material that promotes sustainable design.

In order to achieve those goals, the following elements were carefully selected and designed;

- **Simple Floor Plan:** A plan as modest as possible. An open "shell" plan, versus one with lots of rooms closed off with walls. It is less expensive to build, and simple rectangles are always more cost effective than curves or angles.
- **Square Footage:** Trimming the square footage where it is not necessary, and adding it as needed.
- **Simple Detailing:** Designing to rely on straightforward elements versus those that are more complex and, thus, more expensive to build.
- **Materials:** Sustainable materials such as recycled and composite products. The Structural Insulated Panel system promotes the green design.
- **Stock Sizes:** Off-the-shelf sizes, and prefabricated materials and building systems (precut concrete foundations, cement board siding, prefab trusses),

are used, which promote both cost effectiveness and sustainability in order to reduce waste.

- **Long-term Planning:** Affordability approached from the perspective of both short-term and long-term benefits. Materials chosen for their durability, life span, and minimal maintenance requirements. These sometimes can cost more at the onset, but over time the savings will accrue.
- **"Adaptability" and "Visitability"**: Accessible area for a person in a wheel chair who lives in the house or is a guest in the house. Designing a one zero-step entrance, doors with 32 inches of clear passage space, one bathroom on the main floor accessible for a wheelchair.

Life Cycle of the House

Phase 1: For a young couple

First Floor: 896 sq. ft.

Second Floor: 398 sq. ft.

Total: 1294 sq. ft.

Phase 2: For a young family with small children

First Floor: 896 sq. ft. + a new enclosed garage

Second Floor: 870 sq. ft. (new addition 472 sq. ft)

Total: 1766 sq. ft.

Phase 3: For a grown family

First Floor: 1568 sq. ft. (New addition 672 sq. ft)

Second Floor: 1398 sq. ft. (new addition 528 sq. ft)

Total: 2966 sq. ft.

Phase 4: For an empty nest + mother-law or guest quarters

Main Living Quarters

First Floor: 1568 sq. ft. – (672 sq. ft) = 896 sq. ft

Second Floor: 1398 sq. ft.

Total: 2294 sq. ft.

Mother-in-Law or Guest Quarters

First Floor: 672 sq. ft

Second Floor: 0 sq. ft.

Total: 672 sq. ft.

Phase 5: Residence 1 + Residence 2

Residence 1

First Floor: 896 sq. ft.

Second Floor: 870 sq. ft.

Total: 1766 sq. ft.

Residence 2

First Floor: 672 sq. ft.

Second Floor: 528 sq. ft.

Total: 1200 sq. ft.

At Phase 1 of the development, the house is designed for a young couple who seek future expansion of their family. The house will be equipped with a kitchen, dining area, living room on the first floor, and a loft space for a bedroom and bathroom on the second floor. It will also have a slab driveway that extends past the area of the future Phase 2 garage, to where the north edge of the patio line ends. This provides for a larger outdoor patio living space.

At Phase 2, of the development, a garage will be added to the first floor and a master bedroom suite will be added to the second floor. The Phase 1 loft area will be converted into a bedroom for a child or children.

At Phase 3, the final stage of the expansion, a living room, a guest room or office, craft room and an ADA accessible shower room will be added to the first floor and two bedrooms, a bathroom, and a deck will be added to the second floor. The Phase 2 bedroom for a child or children can either be kept as a bedroom or be converted into an entertainment area for an active family possibly with teenagers.

At Phase 4, there are a few options for downsizing the house for a family that has decreased in size as the children become older. One option is that the first floor Phase 3 room addition could be changed to provide either office quarters or guest/mother-in-law

quarters. Another option, because the Phase 3 addition has been equipped with a separate entry and can be separated from the main unit, is to rent out that area as a retirement income source.

At Phase 5, by adding a stair case in the open area shown on the Phase 3 addition, the house can be converted into a duplex. The homeowner would then have a choice to either continue living in the main unit (Phases 1+2) or living in the unit created in Phase 3. The area he chooses not to live in can then be rented out with even a larger retirement income source.

SECTION F
DESIGN MODELS

Project 1: NowHouse

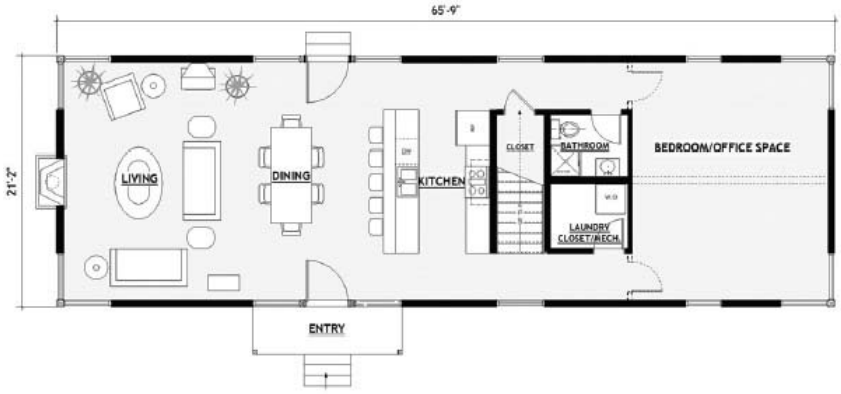
Architect: Toby Long, CleverHomes

Location: San Francisco, California

1. Exterior View: Front

2. Interior View: First Floor

3. Interior View: Second Floor



4.First Floor Plan

5. Second Floor Plan

Source: http://www.fabprefab.com/fabfiles/fabzone/136-NOWHouse/NowHouse%20status.htm

The NowHouse is eco-friendly, high tech, and flexibly designed to manage a lifetime of change and it is a 21st-Century model for sustainable living.

The NowHouse is designed to fit in with a diverse range of locations and domestic living arrangements, in many ways, the 2400-square-foot prefabricated dwelling is a new and improved update of a classic suburban home. Its sober two-tone exterior siding is distinctive but not over-the-top. Measured, pragmatic, and unlike most conventional housing, the NowHouse provides for future growth through customizable and expandable interiors; everything about the design is carefully calibrated to make the most of the challenges and constraints of modern life.

The NowHouse's most significant feature is an easy-to-assemble and well-planned building system comprised of a kit of parts made up of pre-engineered wall and roof structural insulated panels (SIPs). With the ability to withstand winds of 160 miles per hour the SIPs' load-bearing capacity is evenly dispersed throughout the exterior walls, getting rid of the need for internal supporting walls, allowing for a great deal of flexibility in arranging the floor plan.

The other novel feature of the NowHouse is its designed flexibility. It can be "grown" in stages, following the needs of the residents. A small single-story house can be later turned into a two-story dwelling with a loft-ceiled living room using the re-attachable roof and moveable walls. As the company brochure emphasizes, "By adding simple interior partitions, the house can accommodate from two to five bedrooms. We can also change the overall dimensions of the building to provide for any site constraints or permit regulations, or to provide for additional space." In its forward-thinking, flexible

program, the NowHouse places the sustainability of family life on the same footing as its energy conservation agenda.

The first floor has an airy open-plan design with distinct public and private zones. On one side is an open living, dining, and kitchen area divided by a bathroom and laundry, which acts as a buffer zone between the public and private halves of the house. The flow of space is very well thought out and leaves room for flexible arrangements in which the first floor bedroom/office can be split in two. Doors placed on either side of the space anticipate separate entrances for newly created rooms. The second floor consists of a master bedroom with an in suite bathroom and an additional loft-style room, which may be used as a junior bedroom or family room.

The flexible design and eco-friendly performance of the NowHouse makes it one of the most elusive and innovative products in home building—it has the capacity to be all things to all people. For the luxury builder or customer, the home is thoroughly smart, wired throughout for security and digital systems. For the environmentalist, the house will provide all the components of a pioneering eco-friendly living.

It incorporates several technologies that improve energy efficiency, durability and affordability. Examples include:

- home run plumbing
- tankless water heater
- low-flow plumbing fixtures
- greywater reuse

- air admittance vents
- PV roofing
- solar water heaters
- radiant barriers
- HVAC optimization
- mini-duct air distribution system
- high efficiency air conditioners without HCFC
- low impact development techniques
- ENERGY STAR windows, doors, appliances and insulation levels
- bamboo flooring, and
- low- or no-VOC paints

The home incorporates a number of technologies promoted by the Partnership for Advancing Housing Technology (PATH), such as moveable walls. All technologies featured in the NowHouse are available today, and the home can be rapidly constructed.

The house is also pre-engineered to grow according to an owner's needs and budget. The NowHouse can start out as a one-story dwelling, and as the family grows, a second floor can be added using a unique system of detachable roof and wall sections. Additional features such as a roof deck, stand-alone garage, or carport can he added as the need arises. NowHouse is available for around $150 per square foot. An upgraded kit, complete with optional interior finishes such as bamboo cabinets, KitchenAid appliances, and other accessories is available for about $200 per square foot. [275]

[275] Referenced: Ima Ebong, *Kit Homes Modern* (New York: Harper Collins Publishers, 2005).

Project 2: FlatPak House

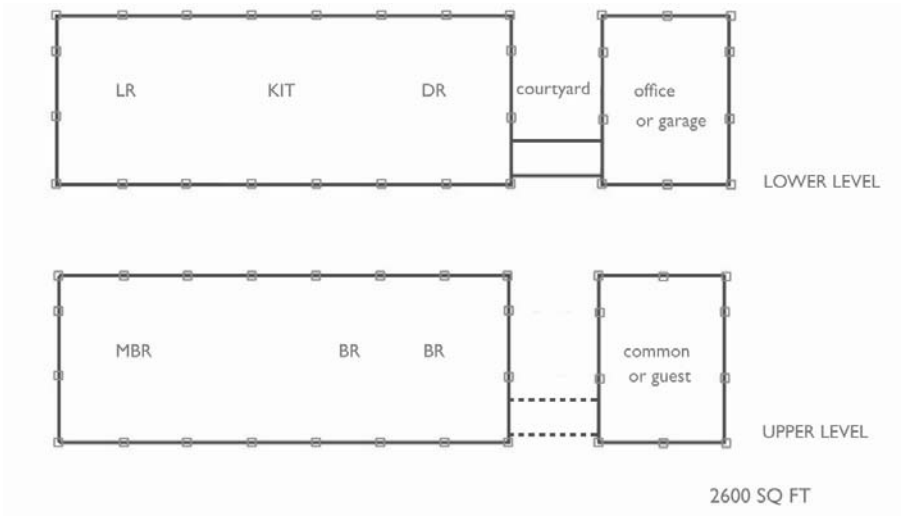
Architect: Charlie Lazor, Lazor Office

Location: Minneapolis, Minnesota

1. Exterior View (Front)

2. Exterior View: Courtyard

3. Interior View: First Floor



Source: www.flatpakhouse.com, http://www.treehugger.com/files/2005/01/flatpak_house.php.

Charlie Lazor, principal of Minneapolis-based Lazor Office, began his exploration of prefabrication in 2002 through the creation of a home for his family. The resulting prototype—a two-story, three-bedroom, three-bath house with a separate study and guest room—was completed in 2004 and launched the FlatPak series.

With the visual panache that might accompany the brochure for a car or computer, the catalogue for the Flatpak House features an array of options and elegant finishes that entices the reader with endless possibilities.

With its unpretentious materials, harmonious design, and flexible layout, the Flatpak offers a vision of modern living with which few might find hard to disagree. The house is the brainchild of Charlie Lazor, a co-founder of BLU DOT furniture Design Company, noted for its use of innovative materials and fabrication technology to produce elegant and affordably priced furniture. Lazor approaches the house as a series of components that are brought together for on-site assembly. This philosophy parallels modern product manufacturing, whether for a chair or a car, that allows parts to be fabricated elsewhere and assembled at one location.

Lazor, a critic of the lack of choice and slow response of the mainstream construction industry to developing quality modern housing, set out to prove that affordability and quality arc not mutually exclusive ideals. “Architecture for the ordinary pocket book” was a guiding principle for Lazor and his aim from the outset \vas to bring the same rigor and detail normally given to custom design within the reach of the average home owner.

To make the Flatpak House affordable yet flexible enough to accommodate a variety of floor plans, Lazor decided on a system of prefabrication based for the most part on standardized interchangeable components. Finding little enthusiasm for the Flatpak concept from more traditionally minded prefab manufacturers, Lazor, with an eye on quality and consistency, sourced materials from a variety of suppliers, not unlike the way the advanced car or airplane maker might outsource components often made off-site by specialists and then transported and assembled at the factory. Similarly the components of the Flatpak House, from the standardized eight-foot wood panels to sheet glass, are manufactured by specialist suppliers and then assembled and trucked to the site.

The FlatPak system is a highly flexible kit of parts that boils down to three basic components: concrete wall panels; wood-framed panels with wood, metal, or cement-board siding; and a wood frame infilled with large expanses of glass. The roof is a metal structural insulated panel (SIP) of Kynar-painted steel and rigid insulation.

The FlatPak system evokes a do-it-yourself attitude by offering owners a wide range of choices and a hand in the layout of their spaces. For instance, one could choose glass, wood, concrete, or metal panels to create a wall, depending on function and location. In this scheme, the homeowner does not assemble the house but rather becomes an active participant in its design. Numerous configurations are possible because FlatPak is based on a simple 8-foot-wide, 1-story-high wall panel. There is no fixed length and up to four stories are possible.

The first Flatpak House, numbered “001” in the catalogue, was completed in the summer of 2004. Lazor and his family quite appropriately tested this first prototype. The

2,600-square-foot house took six months to build and began with the arrival of flatbed trucks bearing the houses unique building system.

On top of the concrete wall, a series of Douglas fir exterior panels are placed and capped by a slim band of windows that allow in light. These panels also provide maximum privacy on the more heavily trafficked west side of the house, which is located next to the popular Kenilworth Trail in Minneapolis.

The opposite side of the house is more open, with floor-to-ceiling windows, which invite in the surrounding greenery. The streamlined horizontal facade of wood and glass is broken up by a covered thruway, which serves as a courtyard patio and dual entrance between the annexed study and the main house. The 20-by-70 foot house is capped by a well-insulated energy-efficient metal roof, which more than surpasses the Minnesota energy code.

The well-thought-out modern interior of the Flatpak is defined by a generous open-plan first-floor interior configured to suit Lazor and his family. The kitchen is centrally located between the living and dining areas, which at first Lazor's wife thought was odd, but later acknowledged in a Minneapolis, St. Paul Star Tribune article, “it really works for the way we live. We'll he right there with our kids.”Upstairs on the second floor the master bedroom with oath is placed at one end of the house. In between the master bedroom and children's bedrooms is a play area. A walkway linking the main house to the guest quarters allows visitors some independence from the family.

The devil is in the details and Lazor reinforced by his design background, has managed to incorporate an impressive array of large and small elements that work as a

unifying whole, dispelling the stereotype of rickety prefabricated housing. The attention to detail reflected in the flatpak certainly puts to shame the cookie-cutter Sheetrock camouflage aesthetic of comparably priced conventional built housing. The detailing in the Flatpak House is both aesthetically pleasing and practical: Wood panels are designed to open in strategic places to allow cross ventilation, the concrete is carefully mixed to give it a smooth finish, and the interior and exterior panels are carefully joined to form as visually clean and pristine a look as possible.

The interior walls are made of strengthened fiberboard coated with easy-to-clean epoxy paint. Kitchen countertops are elegant and inexpensively created using galvanized metal over plywood. Even the lighting is fully integrated into the overall design using specially created light curtains by noted designer Pablo Pardo. Care is taken as well with the look and feel of the kitchen and bathroom fixtures. Flatpak comes with sleek KitchenAid appliances selected from the company's appropriately titled "Architect Series" line, which Lazor also designed in collaboration with the creative team at KitchenAid. The bathroom fixtures are a global amalgam of stylish high-end parts from the German company Duravit and the equally stylish American bathroom fixtures firm Toto, among others.

Lazor calls his approach "manufactured architecture" rather than "prefab." In his mind, it’s a new and different approach to building homes. The components in the FlatPak can be configured in any size or shape the homeowner or site demands. Since it is based on an outsourcing model, Lazor uses many different specialized manufacturers, such as Seelye Craftsman, a Minneapolis metal shop. The FlatPak is different from other

prefab homes. Unlike Res4's design, Lazor's FlatPak travels in panels made of wood, glass, concrete or metal... not in modules

Ease of construction is also key to FlatPak's present and future success. Its post-and-beam construction with engineered assembly is designed to be builder- and inspector-friendly—and it is. It took a crew of four two days to install the foundation and the first-floor walls, two days to set the second-floor walls and floor, a day and a half for the roof, and four days to set the glass. And it's as easy to disassemble, a feature Lazor describes as its most ecological, albeit with one caveat. "I don't subscribe to the idea that you reassemble it somewhere else," he explains, referring to the oft-repeated mantra of the portable architecture movement. "But rather that its ultimate disposal is handled in a more green manner. The parts of this house can be reused. In another context, they could still perform."

One of the most interesting aspects of the Flatpak House is Lazor's realignment of the relationship between architect and client. It is true that conventional stick-built kit houses have traditionally allowed for more client input than usual, giving homeowners the opportunity to custom design their own houses, but that has always been a daunting option that all but the most intrepid do-it-yourselfers have embarked upon. With Flatpak, the flexible and interchangeable nature of its panelized building system lends a "plug-in" aspect to customizing your house, making it potentially an altogether easier experience to contemplate.

With the Flatpak system, Lazor, as architect, neatly avoids having already predestined and reselected the architectural hardware. Lazor's role is more like that of a

fellow collaborator, as he hands a flexible kit of parts for the consumer to use as he or she sees fit. Like a set menu with many items, the buyer can choose from a selection of four floor plans ranging from 1,600 to 2,600 square feet.

There is also a choice of concrete, wood, cement board, metal, clear, or sandblasted glass exterior panels; all are available in a range of colors including a funky playful Madras plaid panel. Each material can be mixed and matched in an endless variety of combinations, lending degrees of privacy, openness, and expressiveness to the house. Among the flooring options are Douglas fir, birch veneer panels, concrete in light black, gray, and white, light blue epoxy, cork, environmentally friendly bamboo, or FLOR modular carpeting.

Lazor is hoping to deliver a complete, erected FlatPak house for $140 per square foot, contingent of course on location (he estimates $190–$200 per square foot on both coasts), site conditions, and local building codes. Design services are offered as part of the package—not at the typical architects' rate of 10 to 15 percent but at the customer-friendly rate of $999 for a home without a site, $1,999 if a site has already been procured. Manufacturing and construction of the first house took six months from start to finish; Lazor is hoping to deliver subsequent ones in four.

FlatPak evokes the playful structure of the Eames House (1945–1949), designed by Charles and Ray Eames for the Case Study House program in California. A version of FlatPak based on Lazor's prototype is produced by Empyrean, an experienced company that specializes in the construction of modern, prefabricated houses. Costs average $175–

$250 per square foot and reflect a complete house package that also includes design, engineering, and project management services.

There is one drawback; the large, glass panel windows don't open in FlatPak Homes, it's not cost effective, Lazor says. However, there are simple steel doors that allow fresh air to float into a room. Overall, Lazor is thrilled with his custom abode, and he has high hopes as he moves the Flatpak House from personal prototype to the mass market. [276]

[276] Referenced: Ima Ebong, *Kit Homes Modern* (New York: Harper Collins Publishers, 2005).

SECTION G
FORMAL CONCEPT

1. **Site**
   - Project Area Map: Novi, Michigan
   - United States Map: Novi, Michigan
   - Site Plan: Typical Example of the Development
   - Site Plan: Roof Plan

2. **Floor Plans**

   Phases 1,2 3 4 and 5
   - Basement

   Phase 1: For a young couple
   - First Floor
   - Second Floor

   Phase 2: For a young family with small children
   - First Floor
   - Second Floor

   Phase 3: For a grown family
   - First Floor
   - Second Floor

   Phase 4: For an empty nest + mother-law or guest quarters
   - First Floor (a)
   - First Floor (b)
   - Second Floor

   Phase 5: Residence 1 + Residence 2
   - First Floor
   - Second Floor

3. **Sections**
   - Section Key Map
   - Section A
   - Section B
   - Section C
   - Section D
   - Section E

4. Elevations

- Exterior Elevation: Transitions of Construction Phase
- Exterior Elevation: South
- Exterior Elevation: North
- Exterior Elevation: West and East

5. Details

- Key Diagram
- Detail A, B, C
- Wall Section I
- Wall Section II
- Wall Section III

6. Sulutions

- Solution 1
- Solution 2

Project Site

Parcel

Water - River

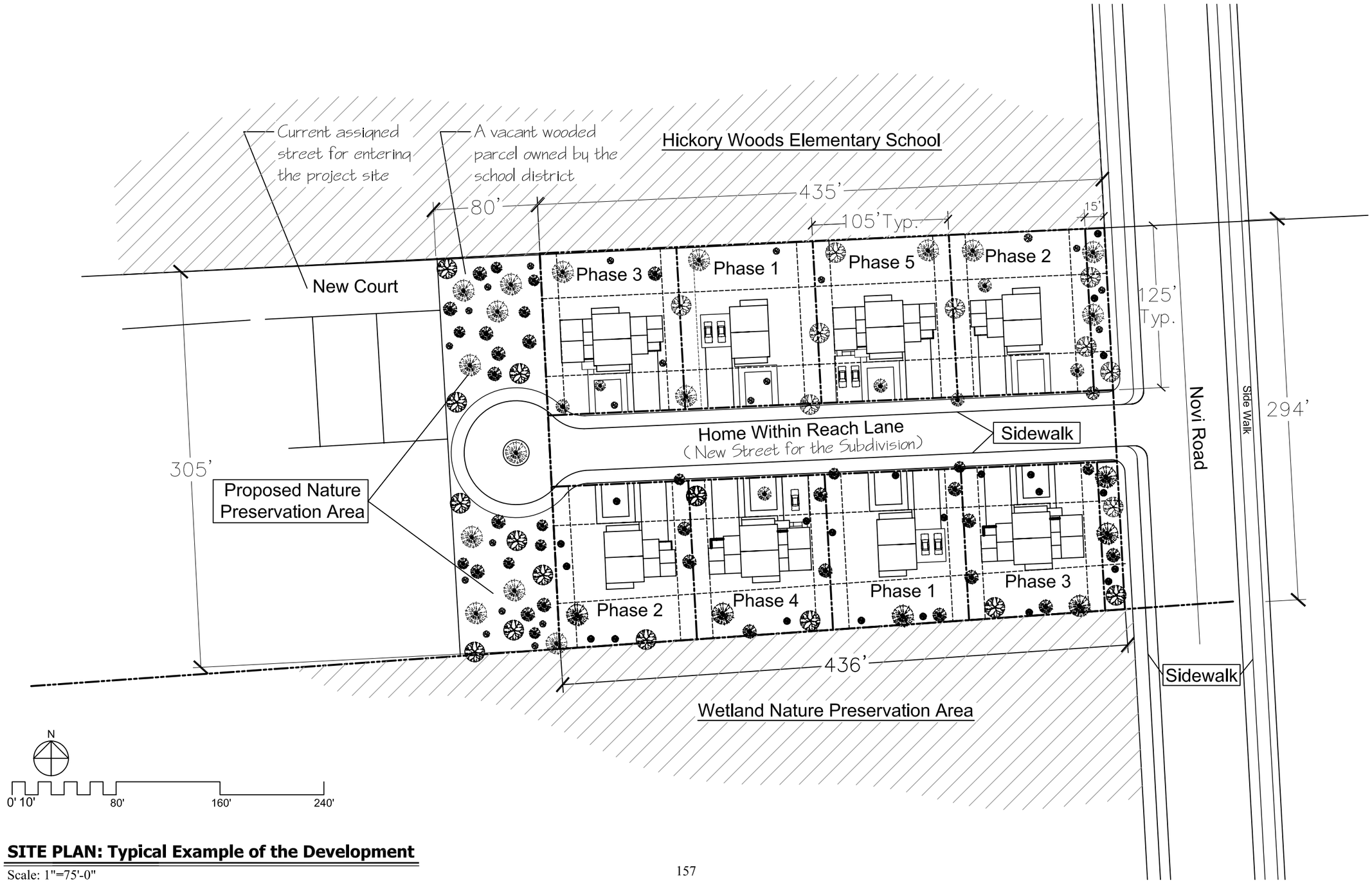
*Source:
City of Novi,Oakland County,
Plan Site LLC;
October 2006 for
County Data,
October 2006 for City Data.

PROJECT AREA MAP: Novi, Michigan

Not to scale

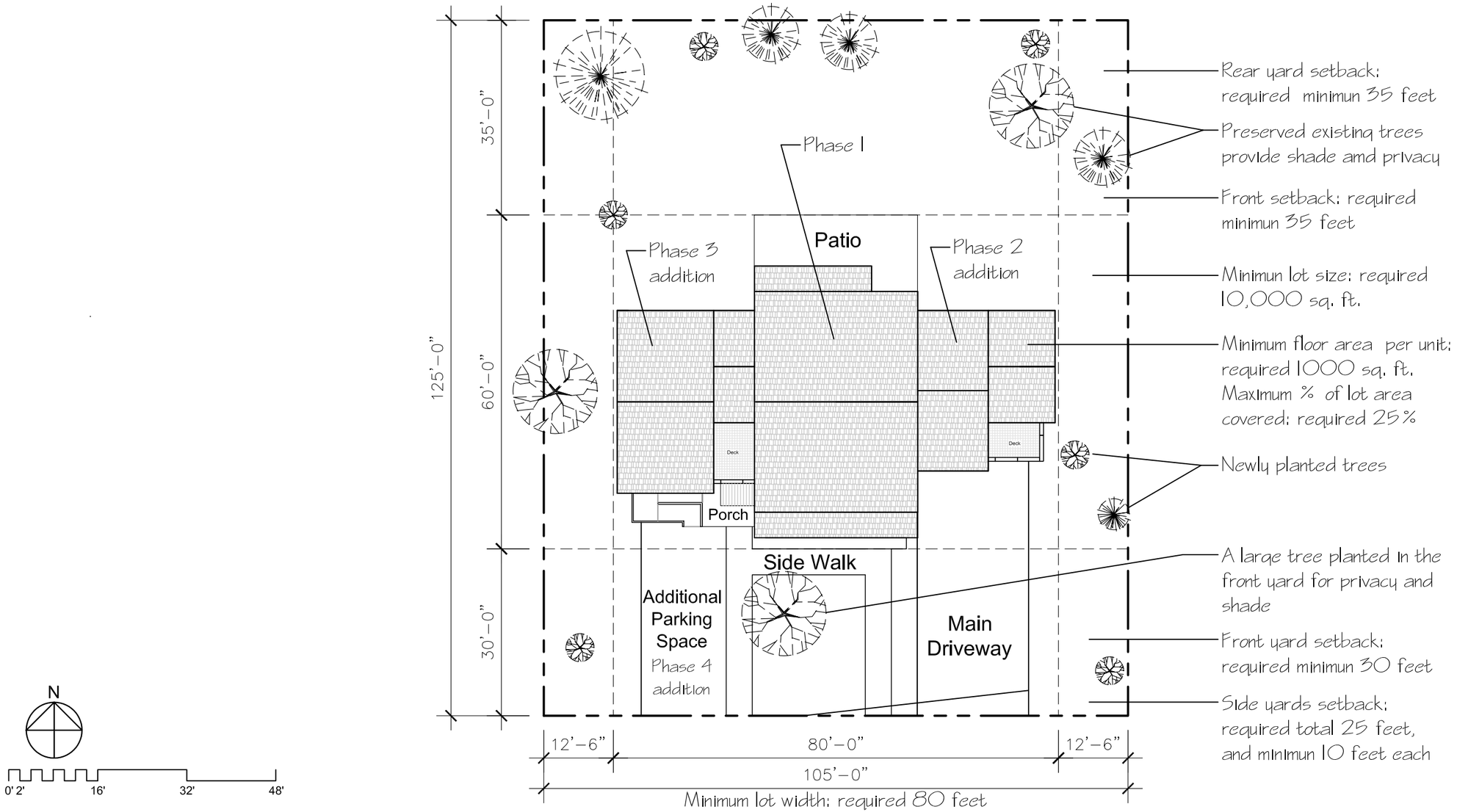
UNITED STATES MAP: Novi, Michigan

Not to scale



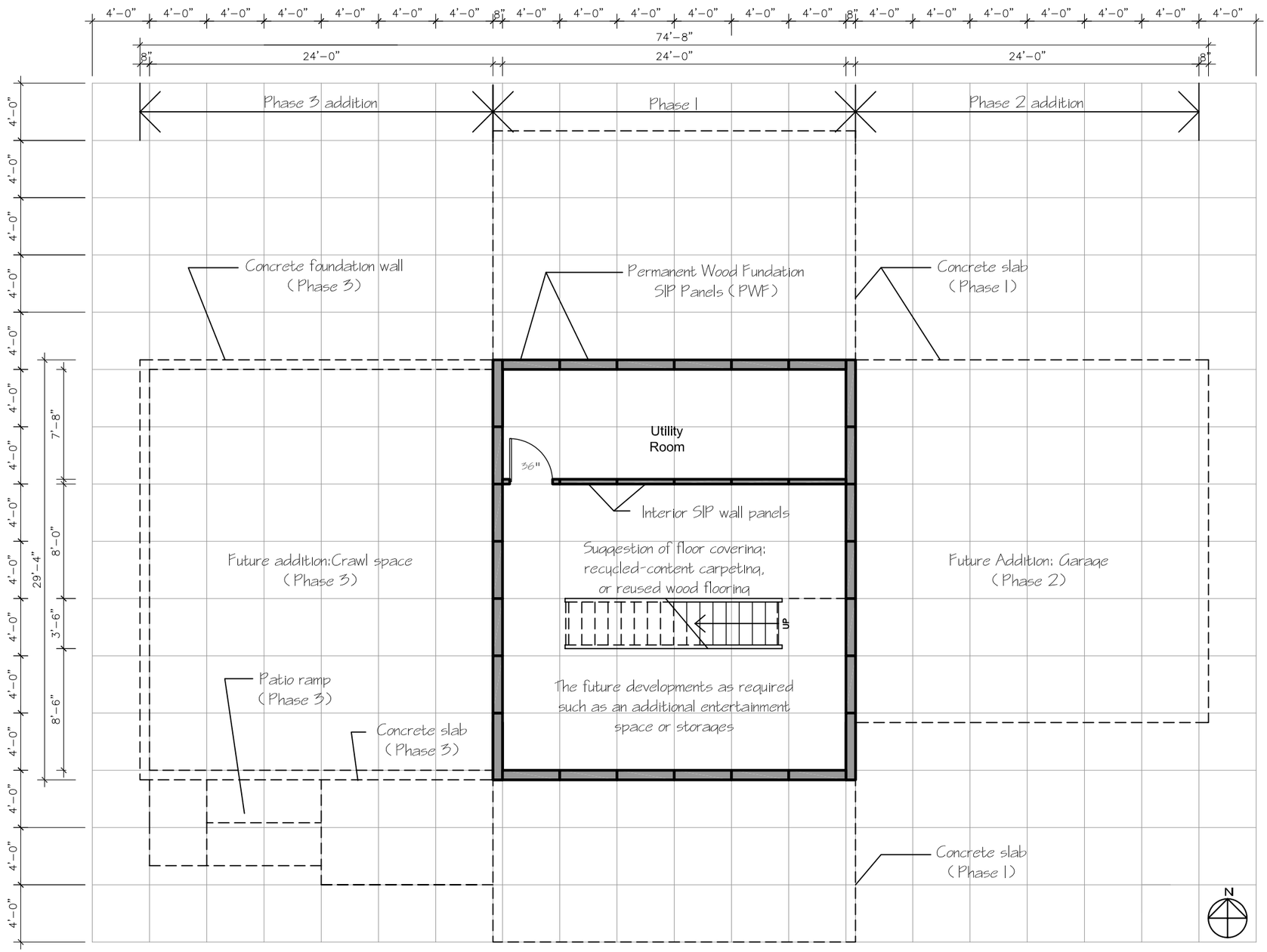
SITE PLAN: Typical Example of the Development

Scale: 1"=75'-0"



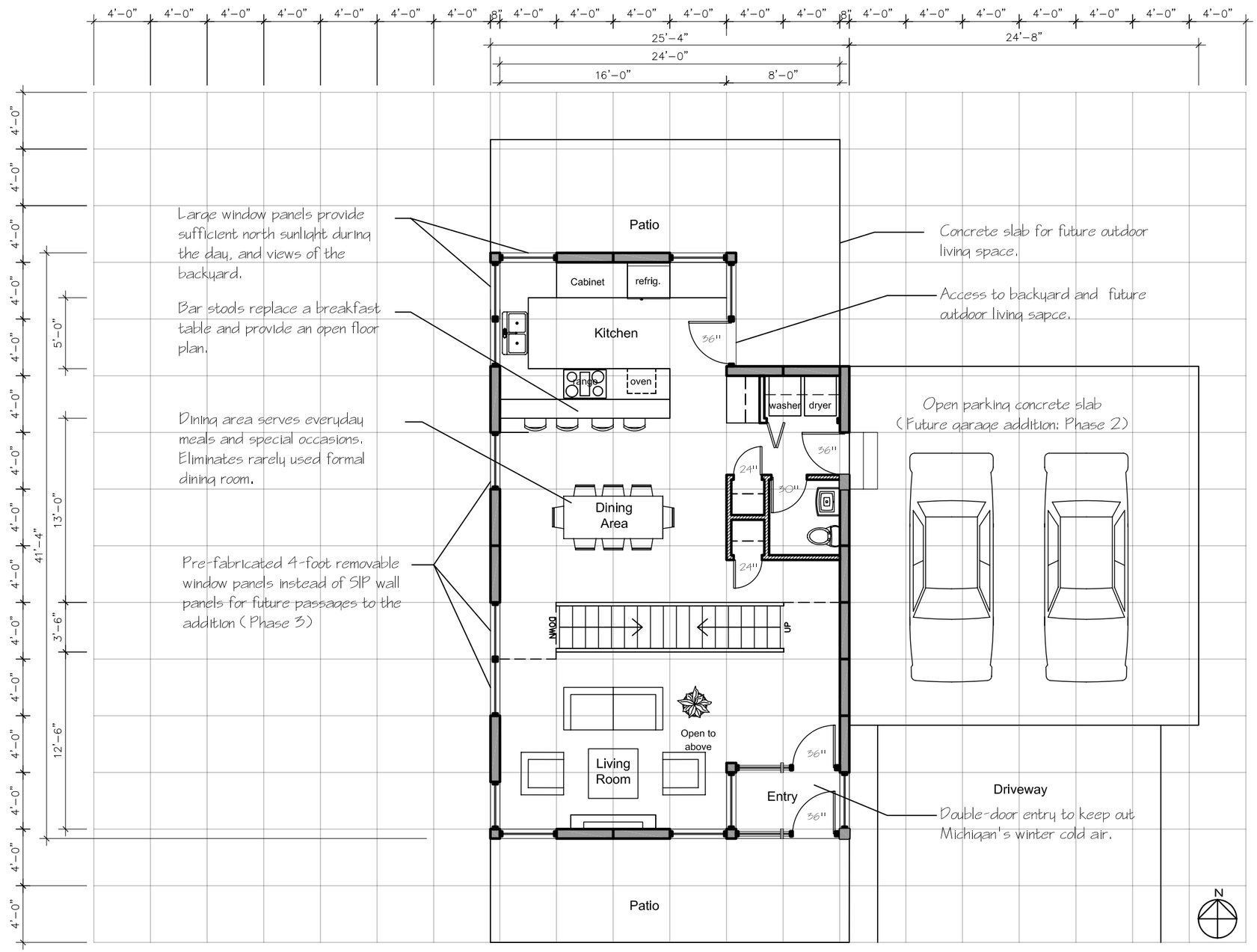
ROOF PLAN

Scale: 1"=20'-0"



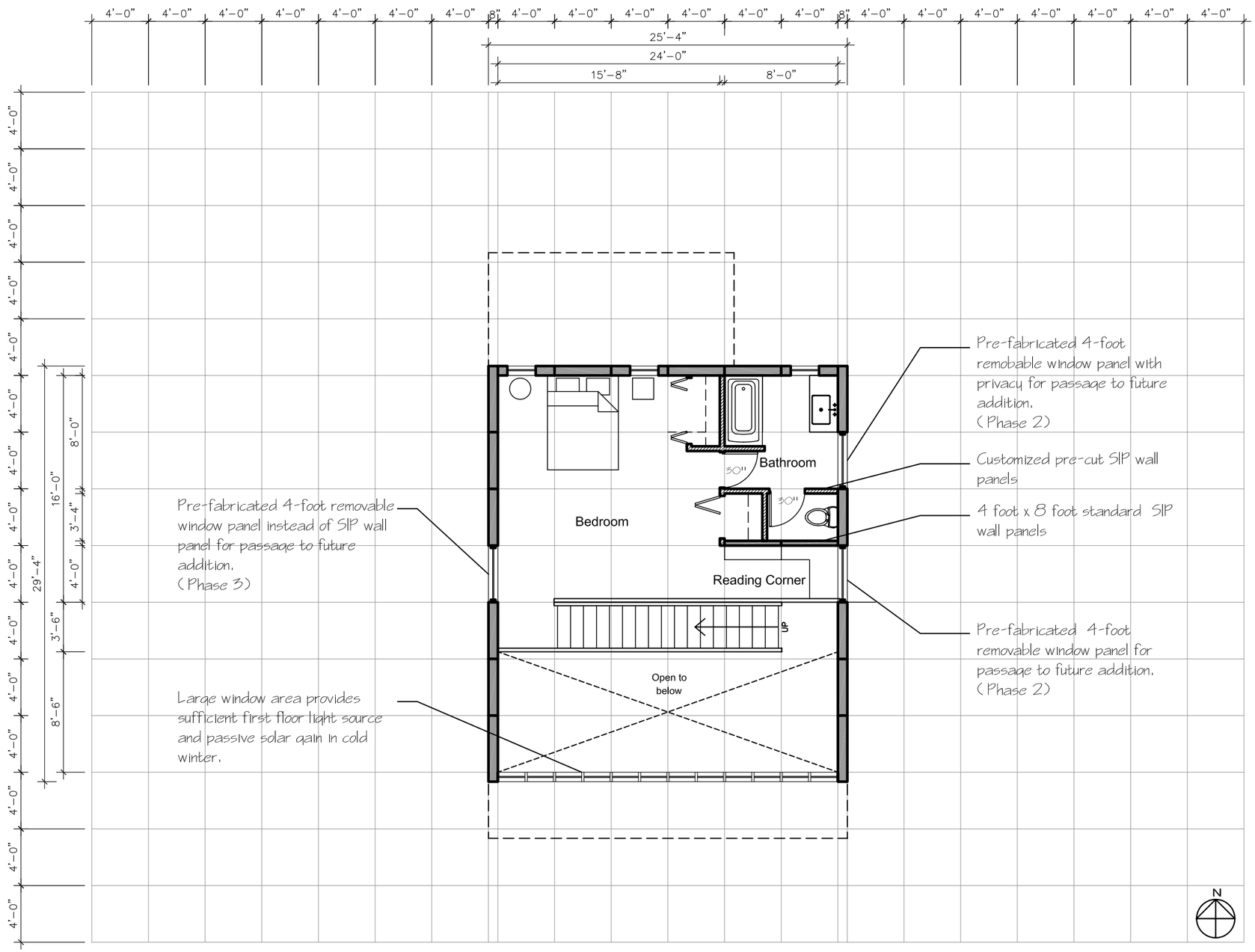
FLOOR PLAN: Basement

Phase 1,2,3,4 and 5
Scale: 1/8" = 1'-0"



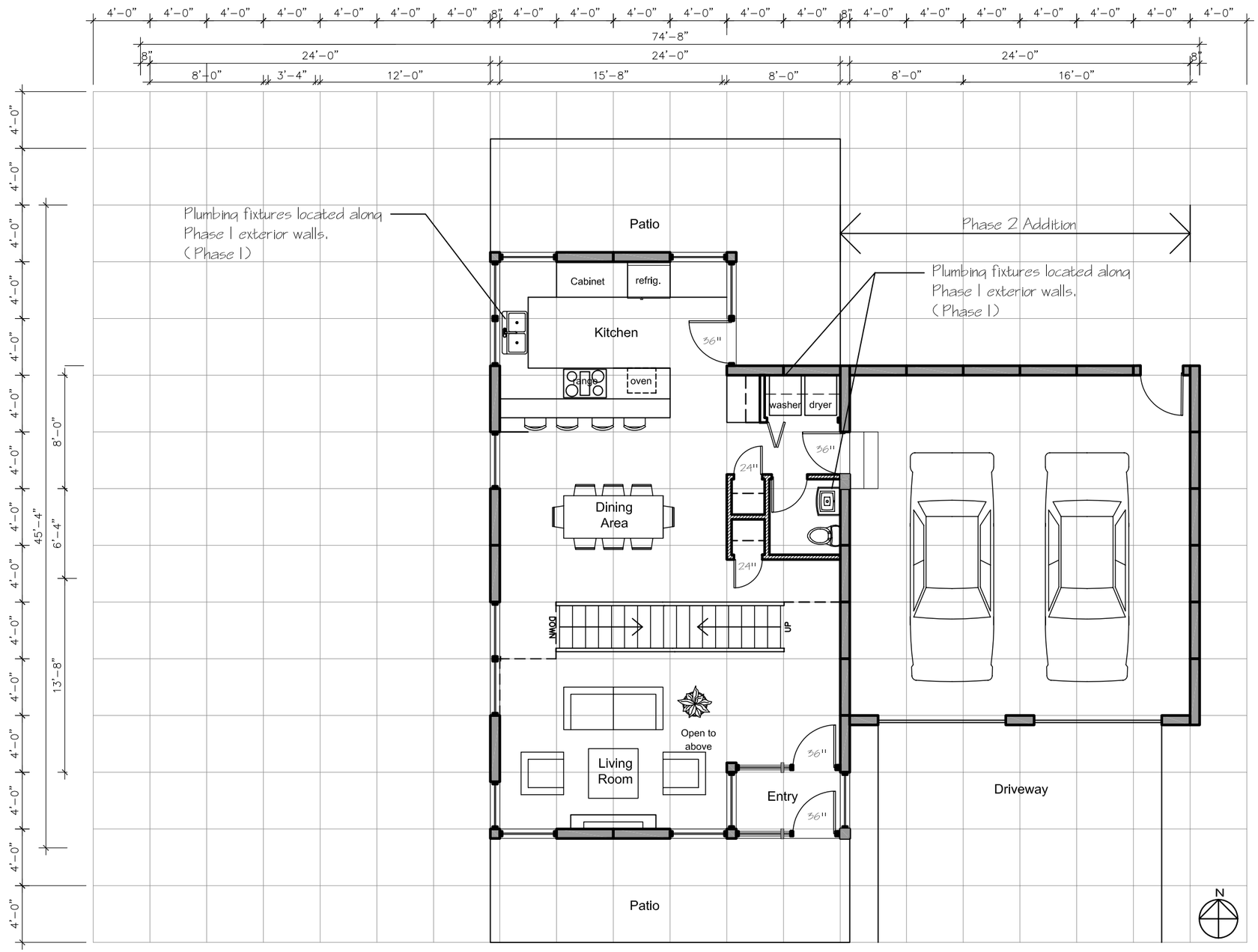
FLOOR PLAN: First Floor

Phase 1:For a young couple
Scale: 1/8" = 1'-0"



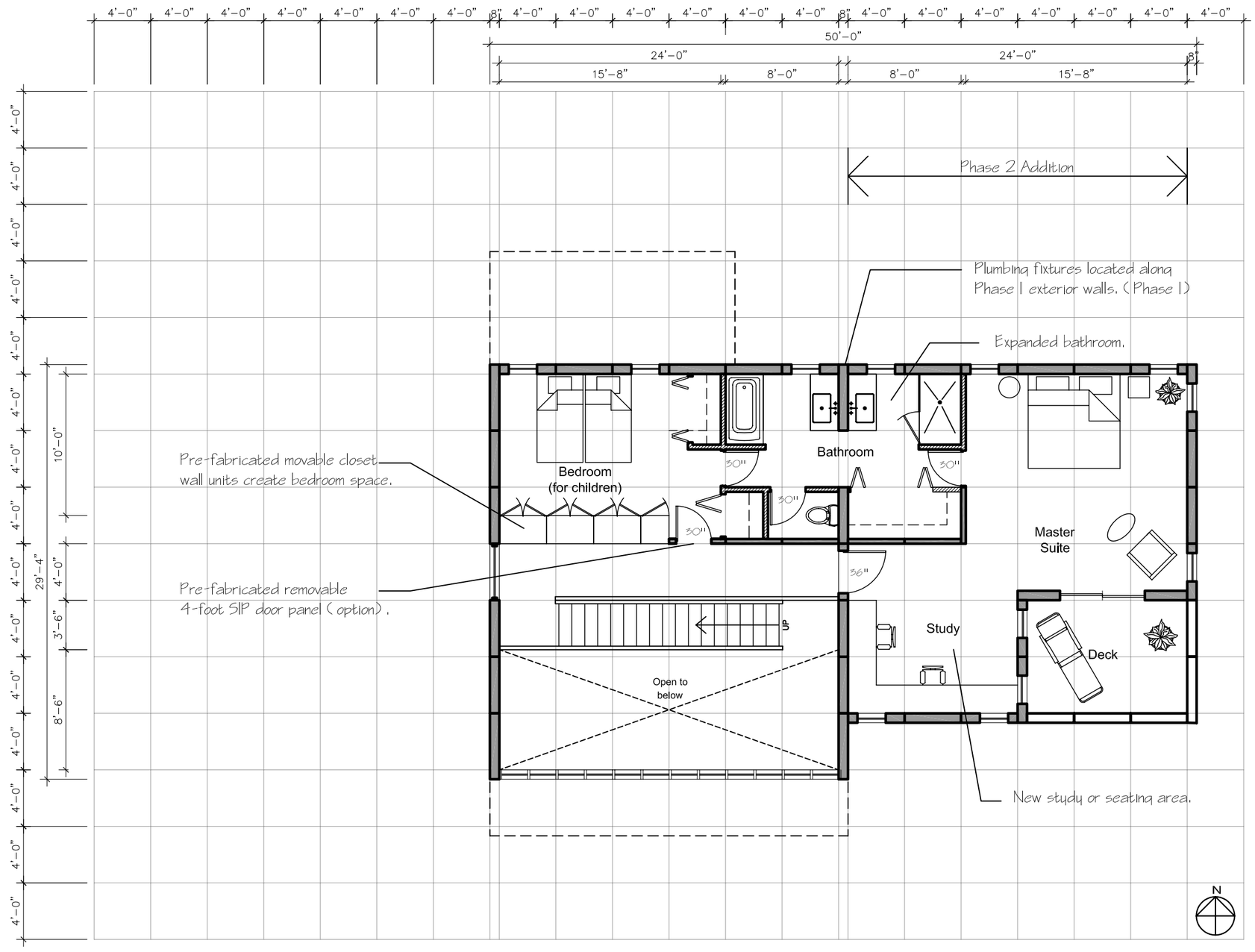
FLOOR PLAN: Second Floor

Phase 1: For a young couple
Scale: 1/8" = 1'-0"



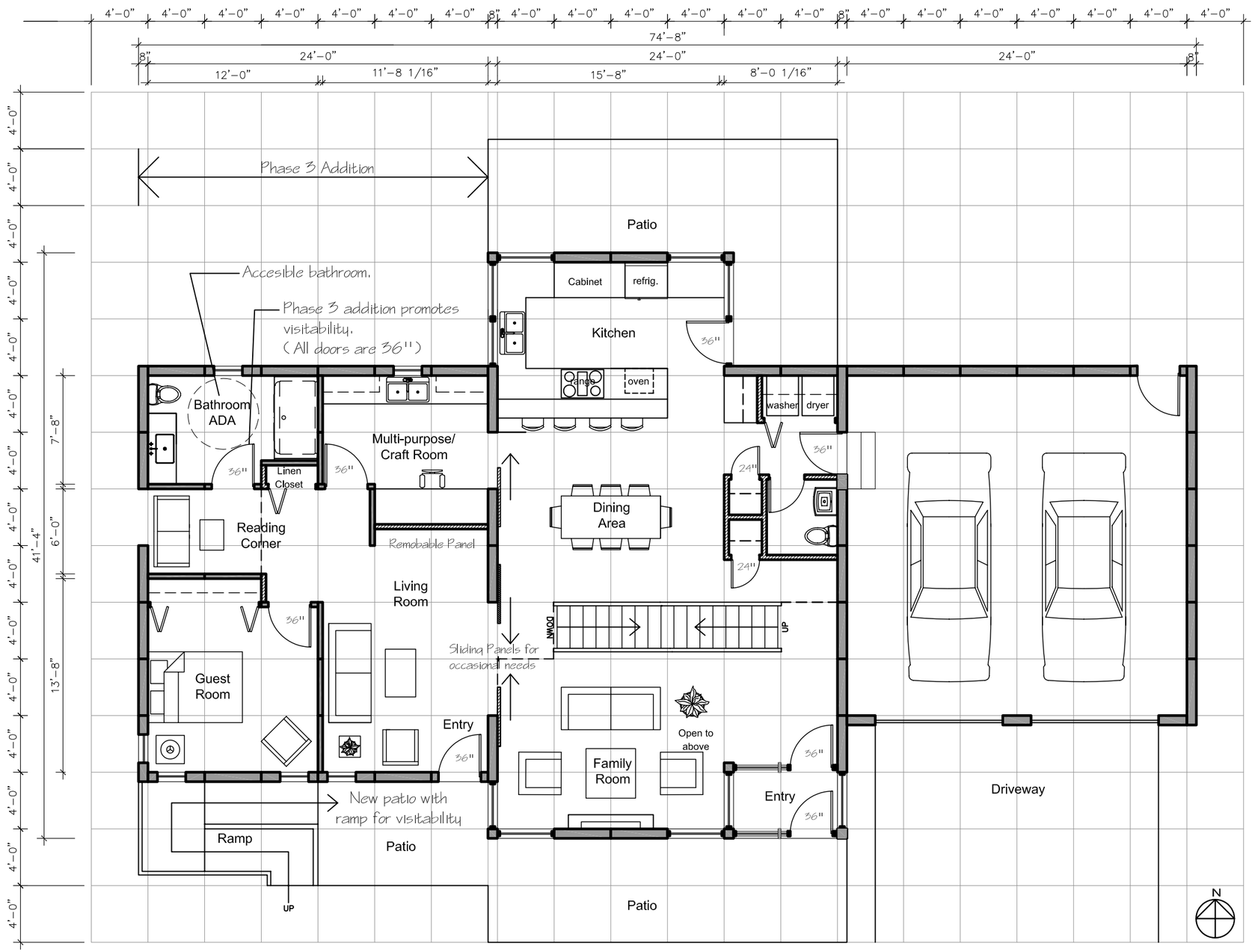
FLOOR PLAN: First Floor

Phase 2: For a family with young children
Scale: 1/8" = 1'-0"



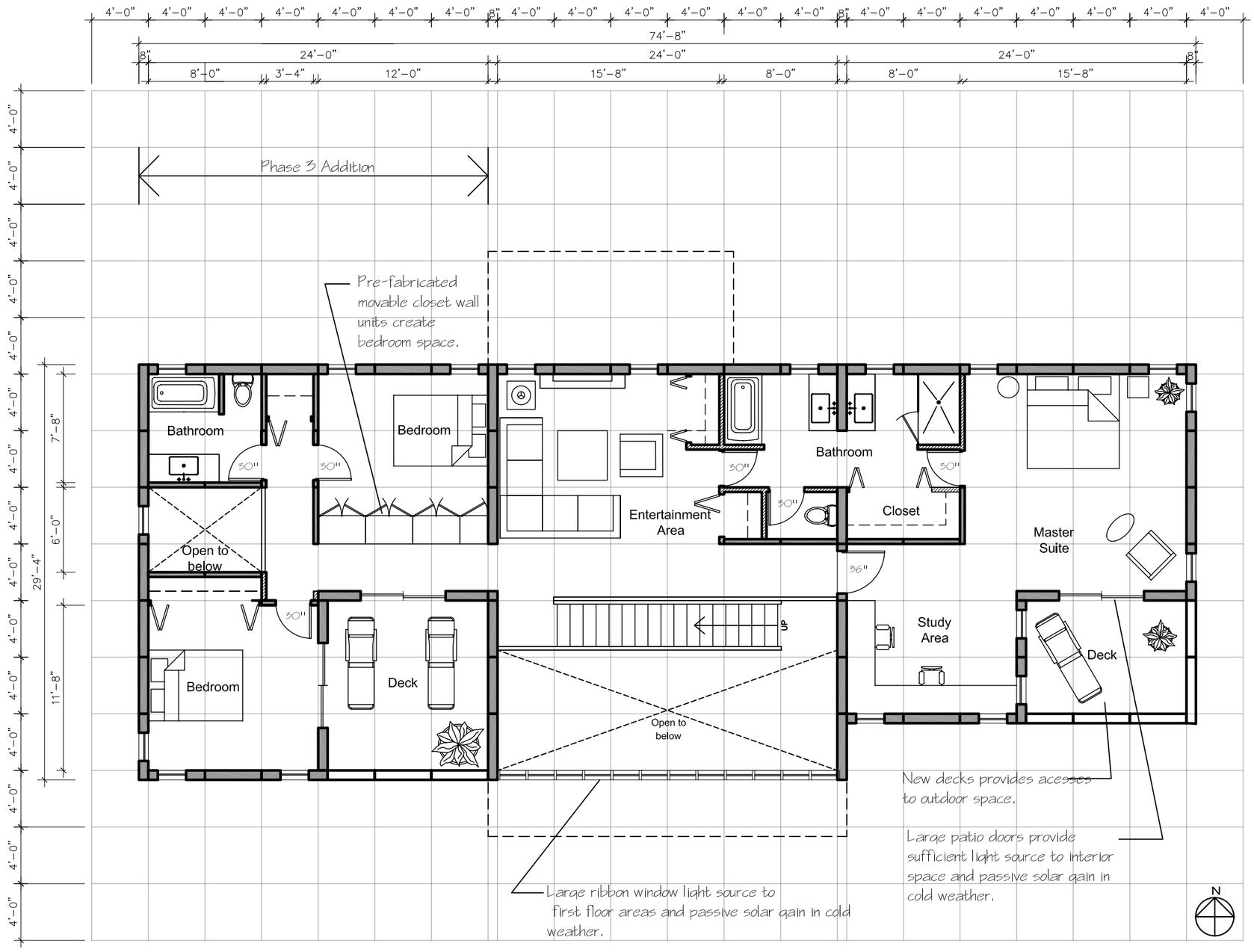
FLOOR PLAN: Second Floor

Phase 2: For a family with young children
Scale: 1/8" = 1'-0"



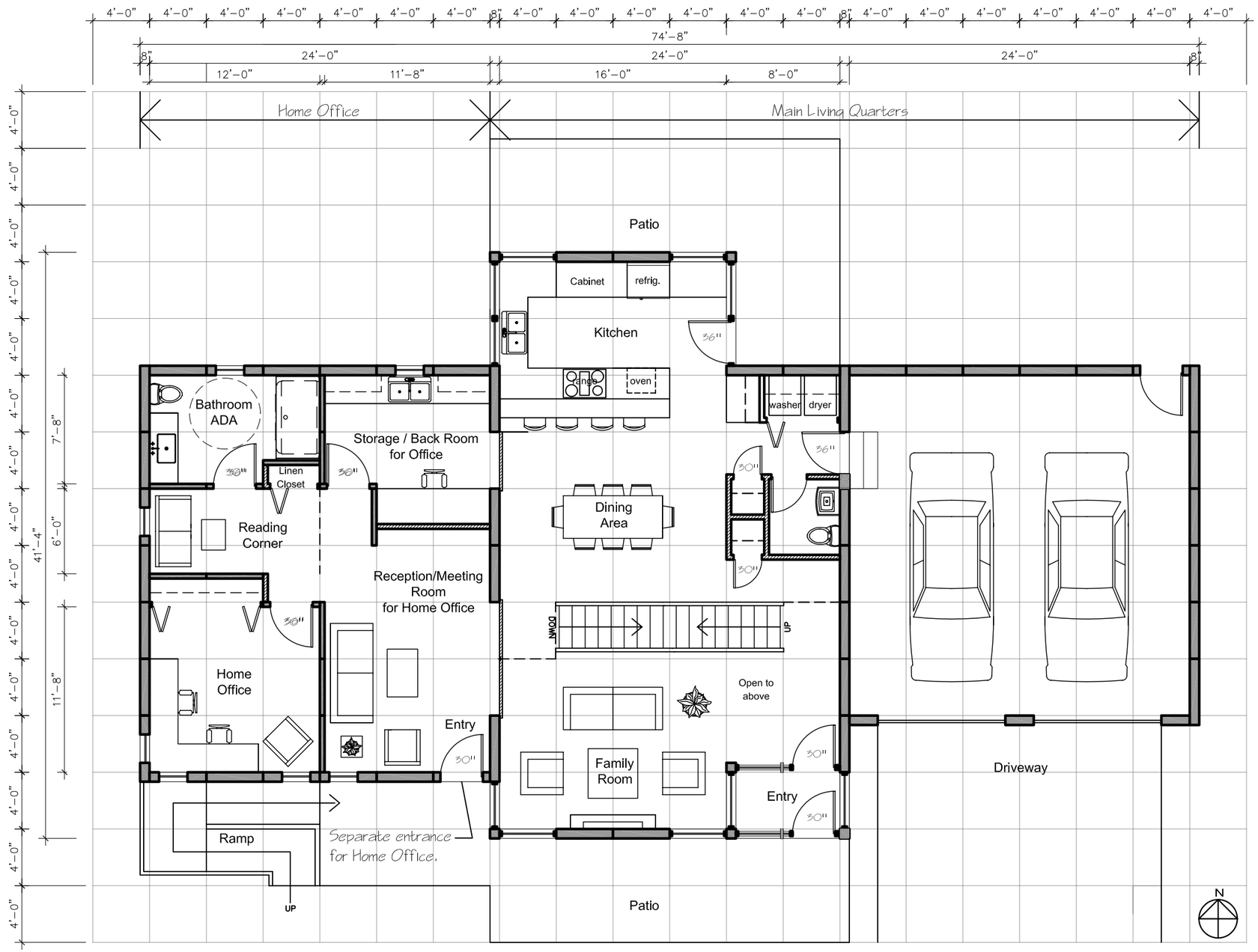
FLOOR PLAN: First Floor

Phase 3: For a grown family
Scale: 1/8" = 1'-0"



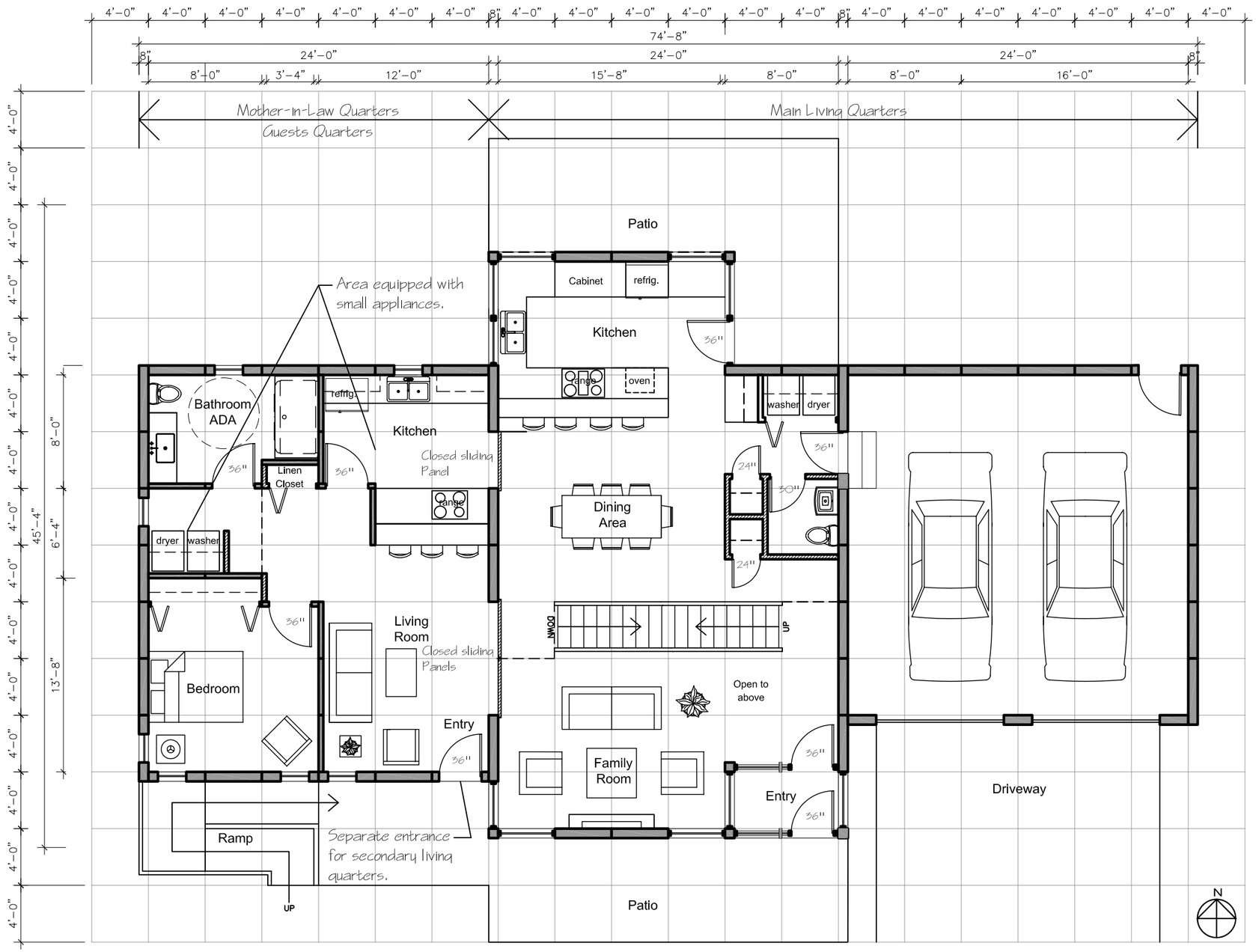
FLOOR PLAN: Second Floor

Phase 3: For a grown family
Scale: 1/8" = 1'-0"



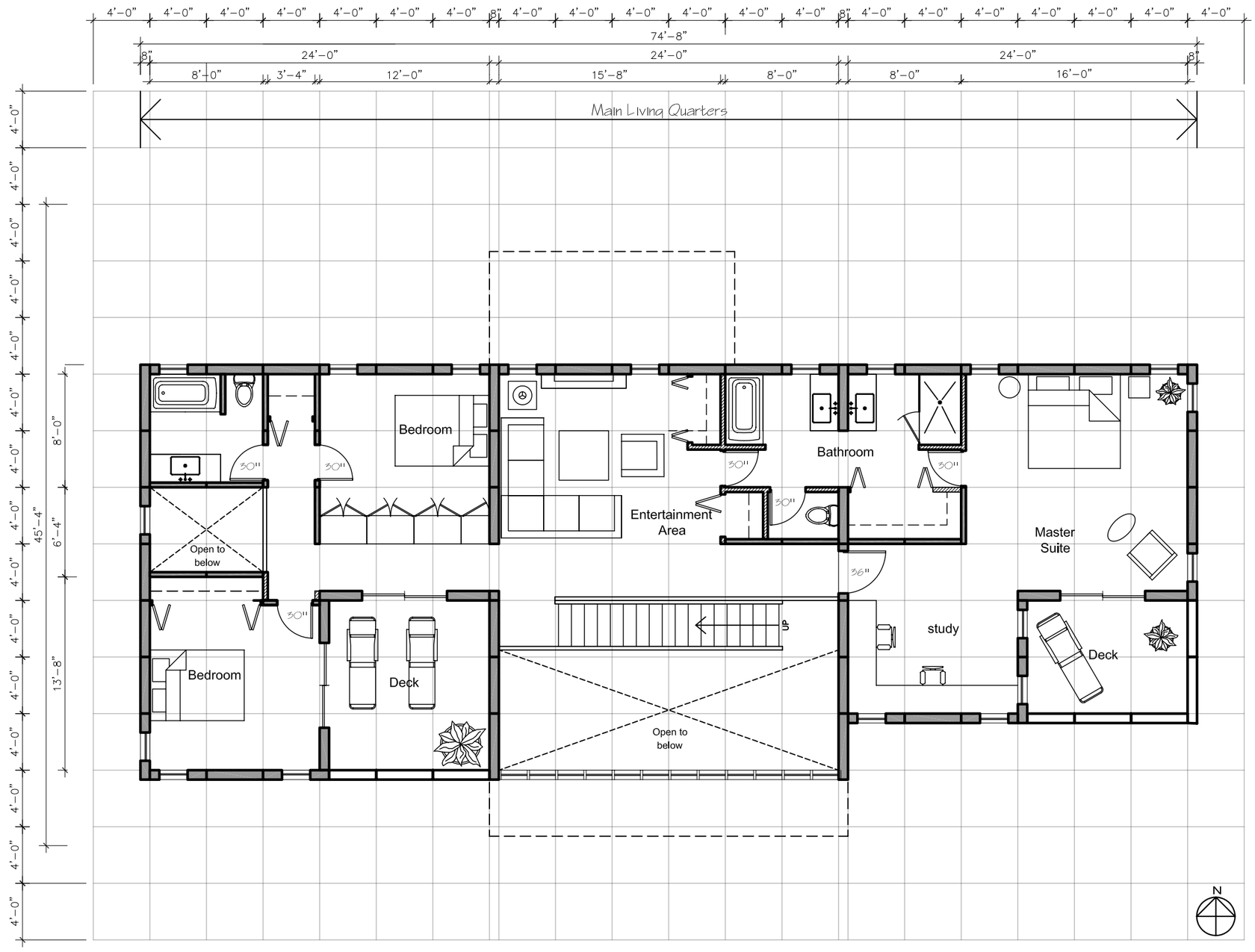
FLOOR PLAN: First Floor

Phase 4-a: A residence with home office
Scale: 1/8" = 1'-0"



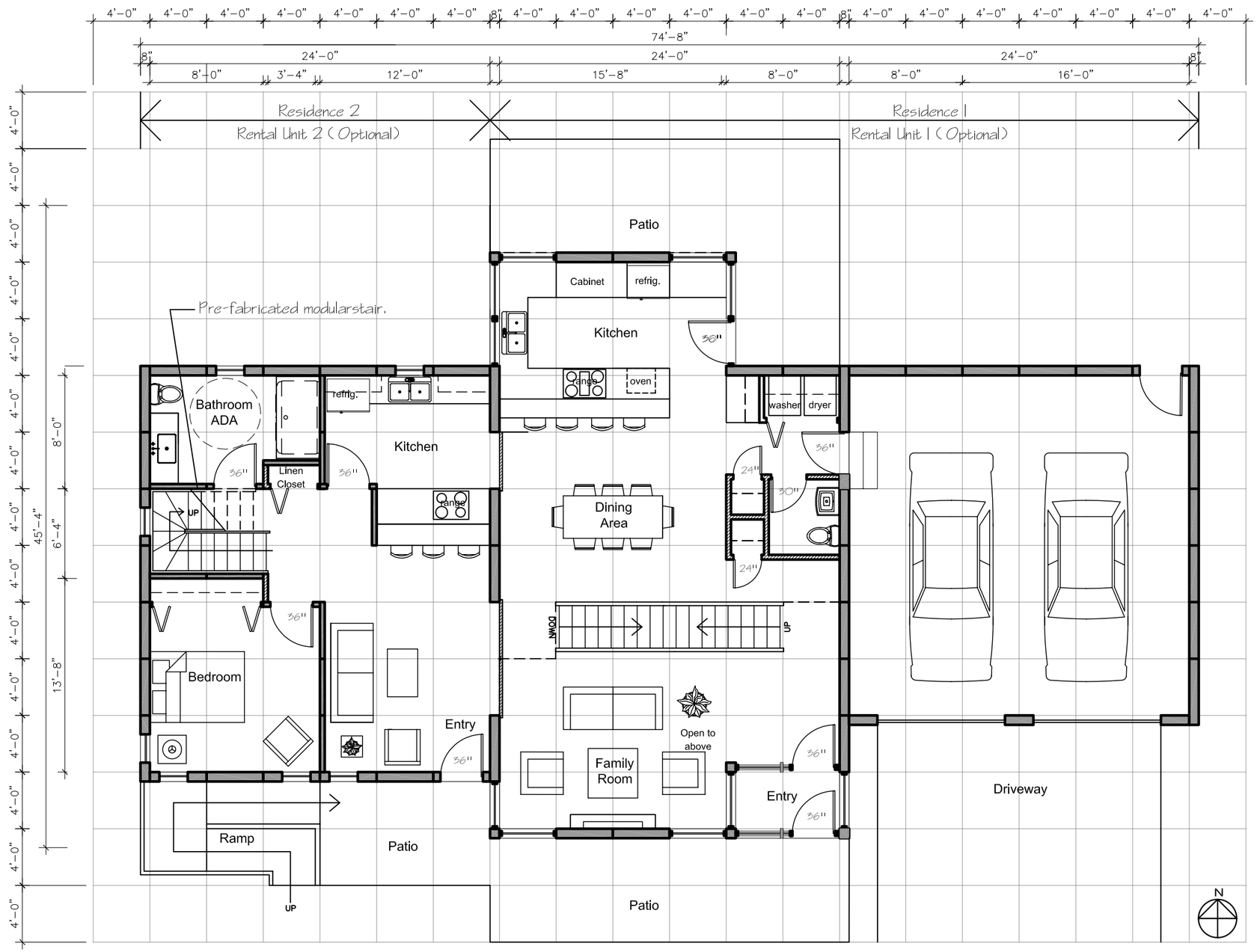
FLOOR PLAN: First Floor

Phase 4-b: A residence with a guest/mother-in-law quarters
Scale: 1/8" = 1'-0"



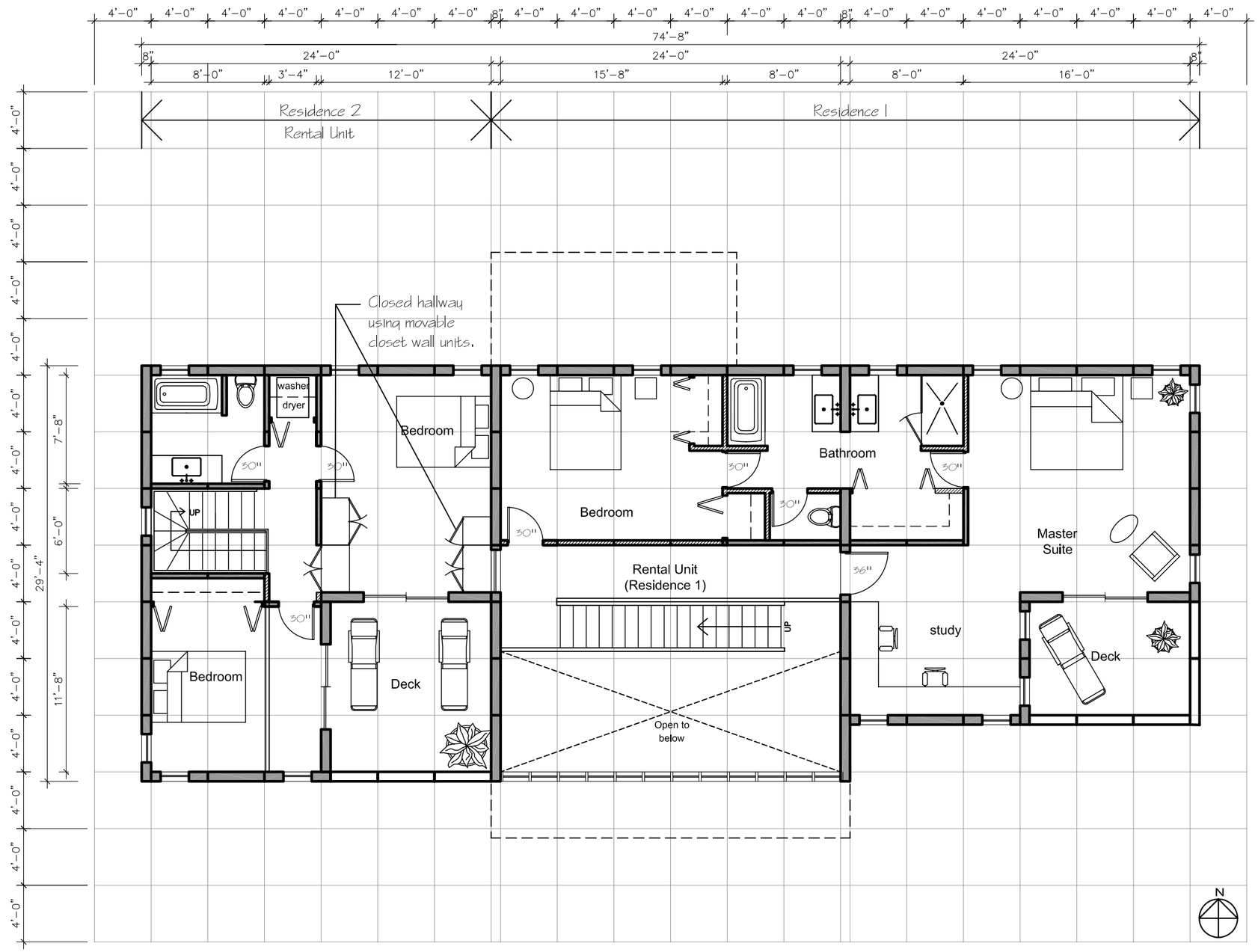
FLOOR PLAN: Second Floor

Phase 4: A residence with quarters (Same as Phase 3)
Scale: 1/8" = 1'-0"



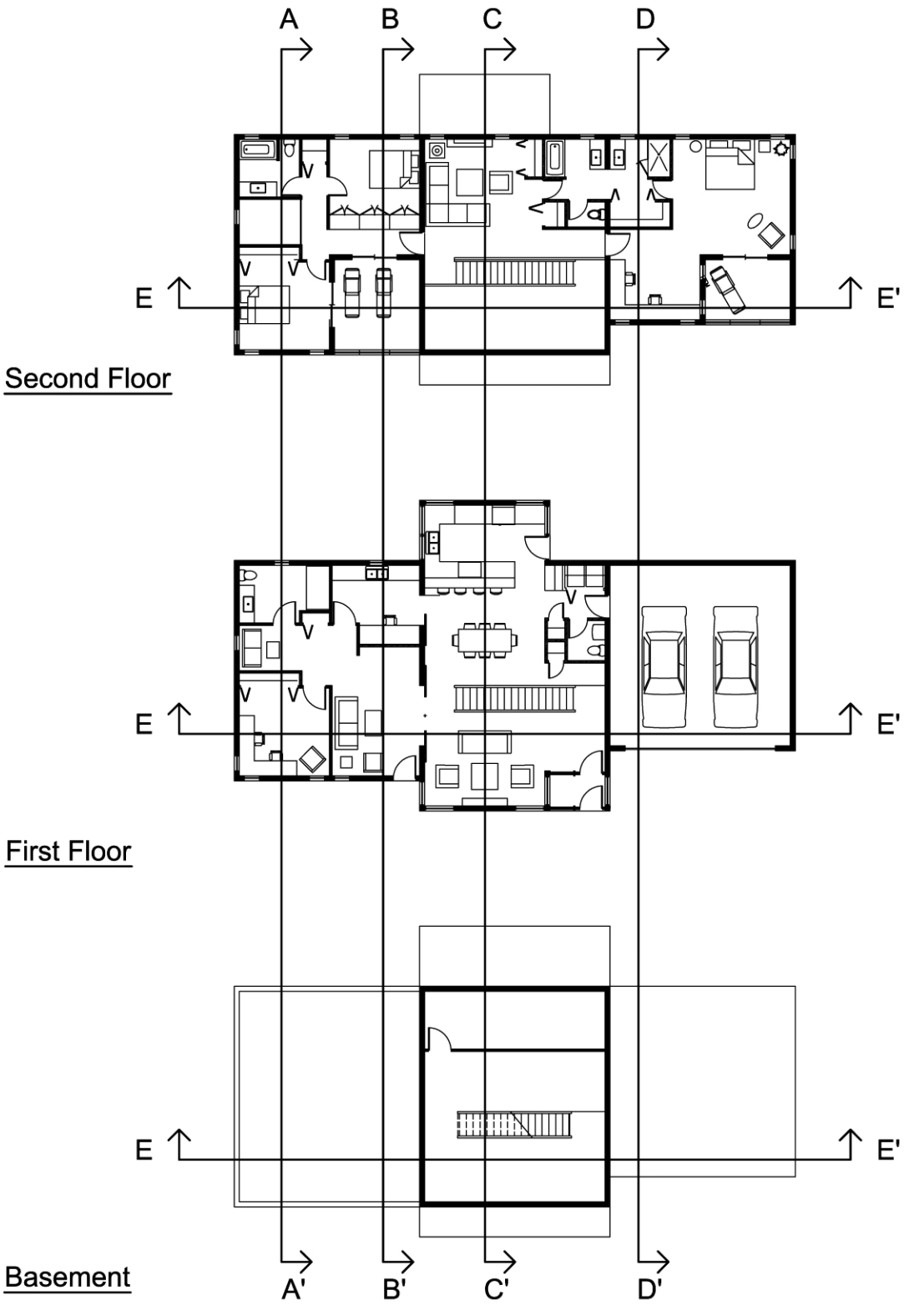
FLOOR PLAN: First Floor

Phase 5: Residence 1 + Residence 2
Scale: 1/8" = 1'-0"



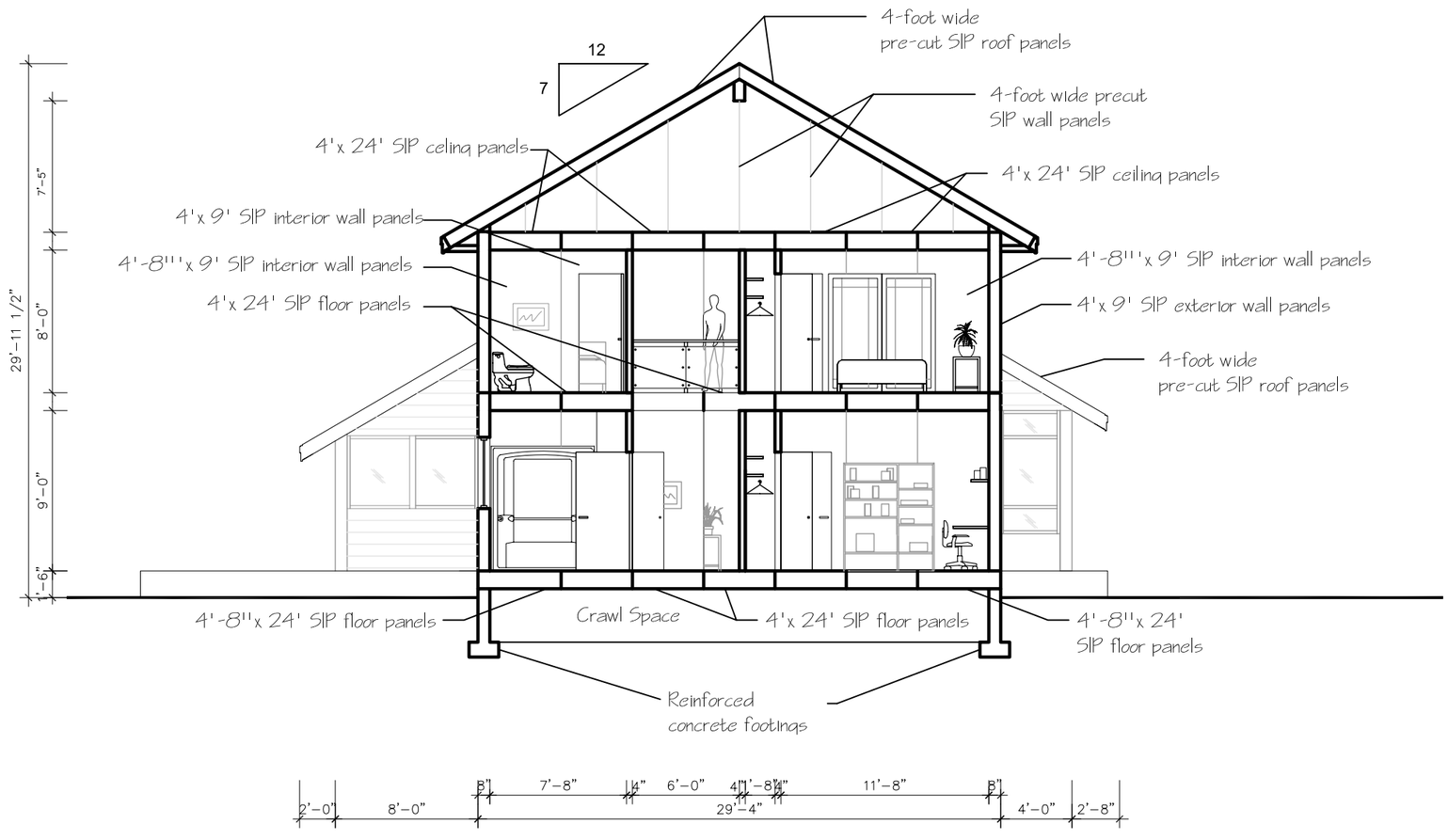
FLOOR PLAN: Second Floor

Phase 5: Residence 1 + Residence 2
Scale: 1/8" = 1'-0"



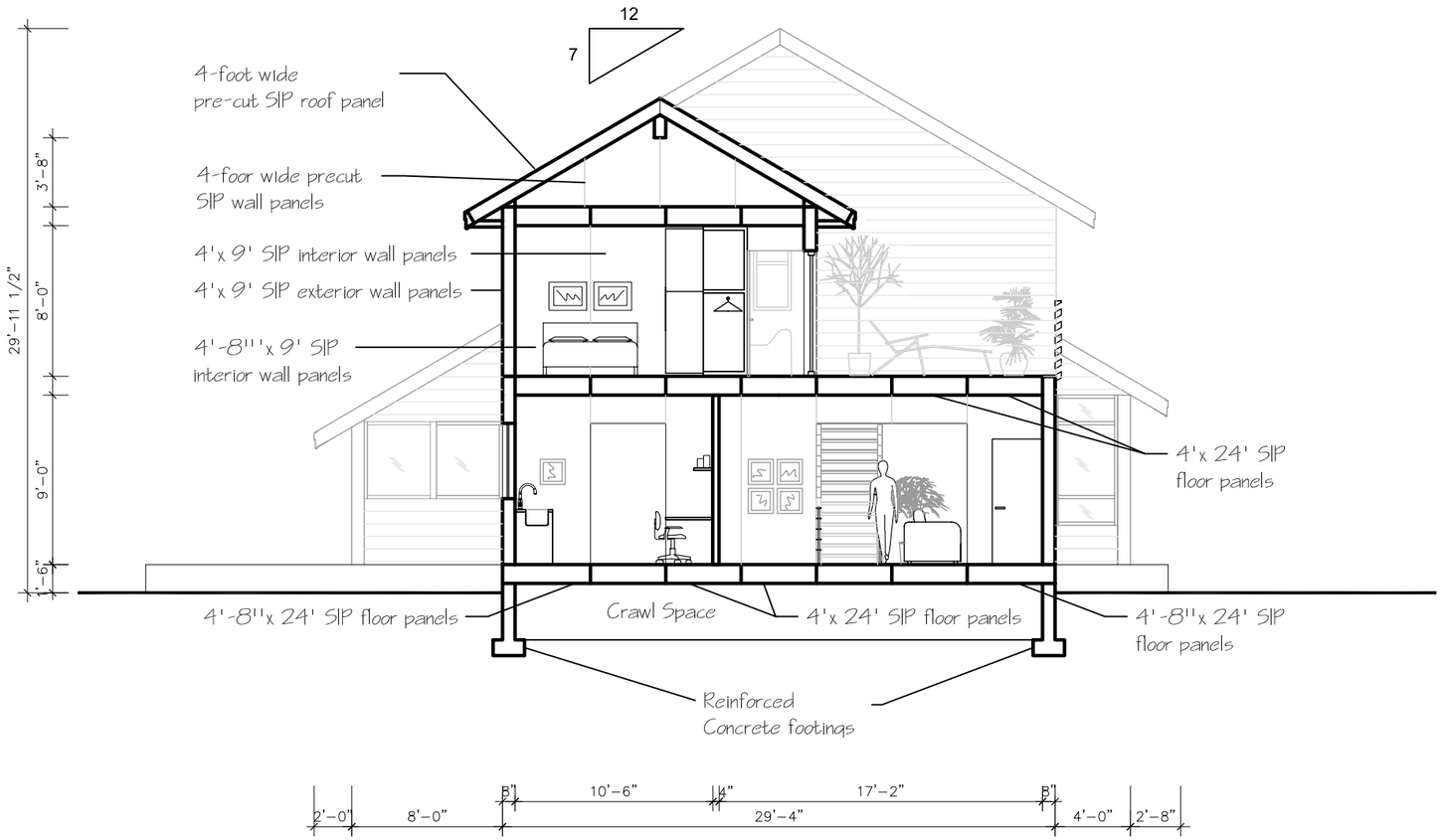
SECTION KEY MAP

Section: A-E (Shown Phase 3 Floor Plans)



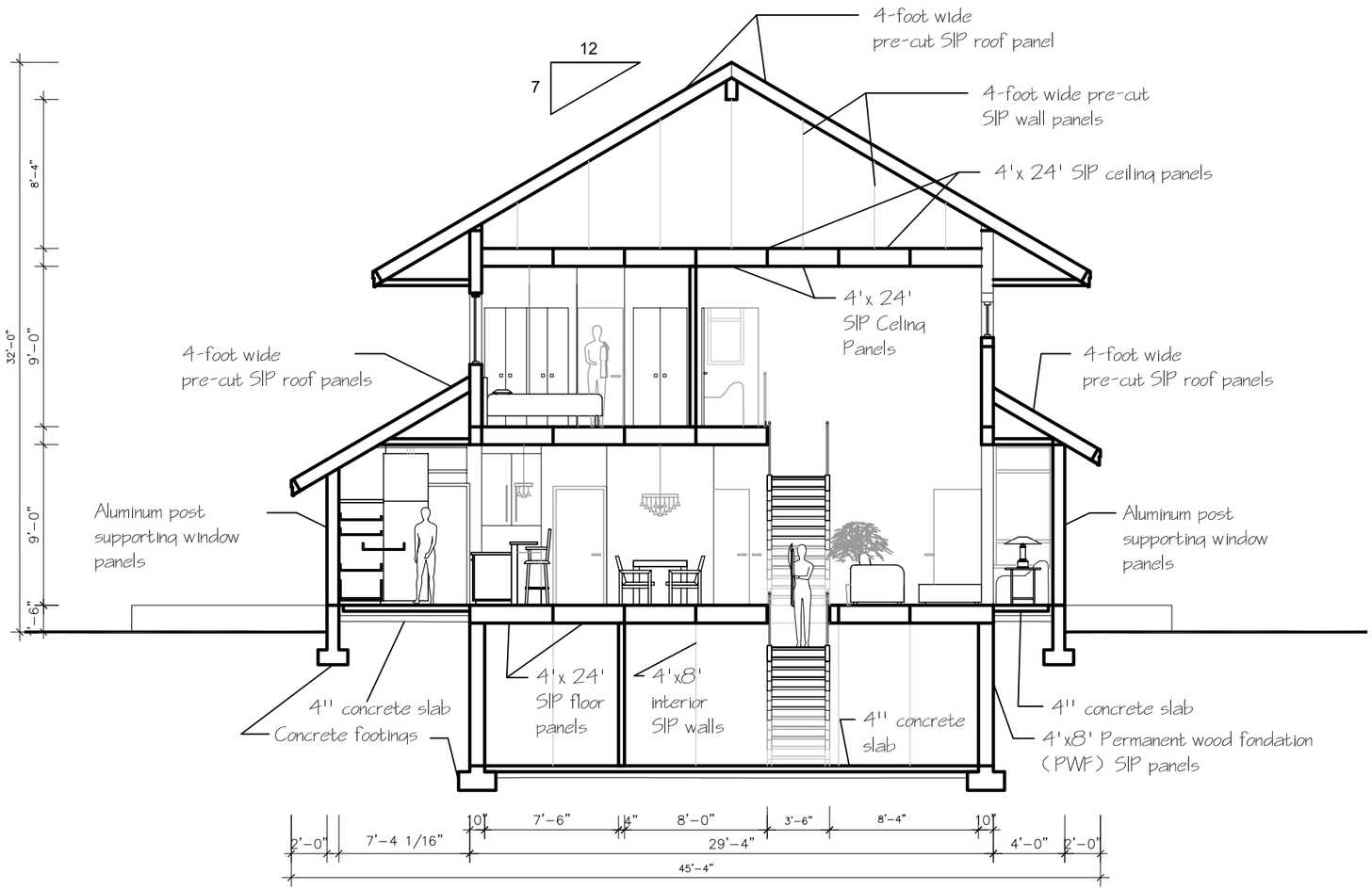
SECTION A

Scale: 1/8" = 1'-0"



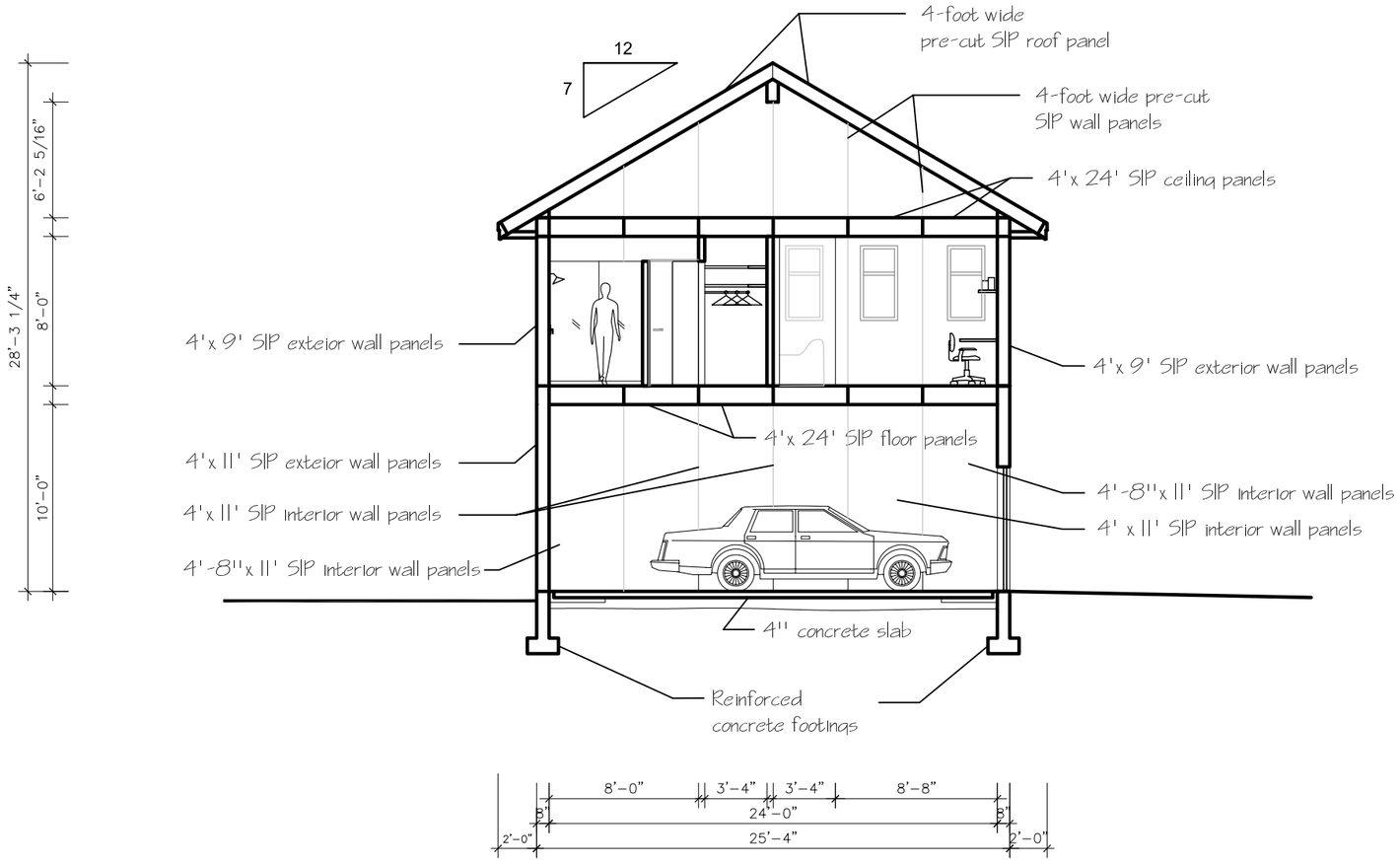
SECTION B

Scale: 1/8" = 1'-0"



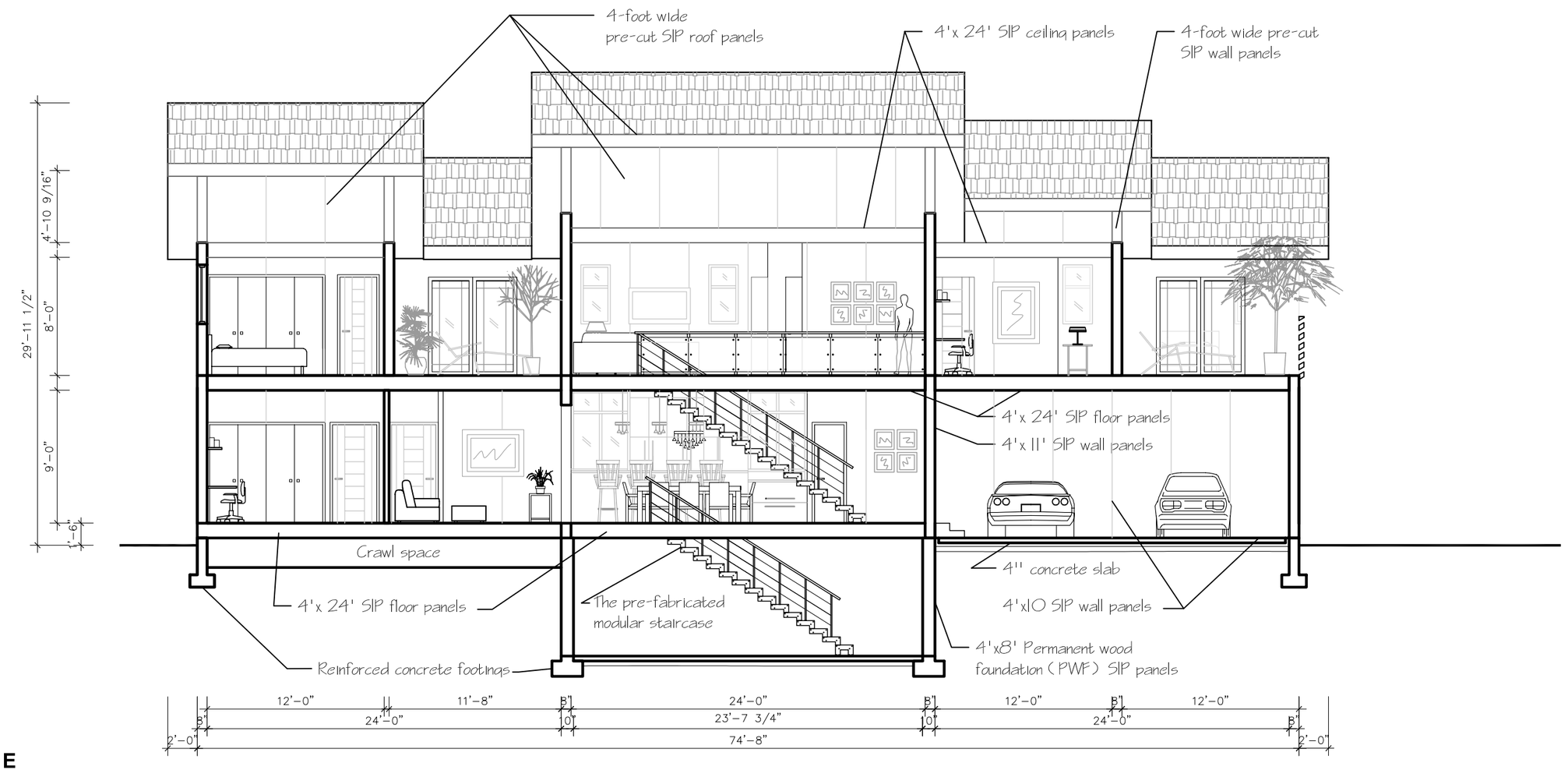
SECTION C

Scale: 1/8" = 1'-0"



SECTION D

Scale: 1/8" = 1'-0"

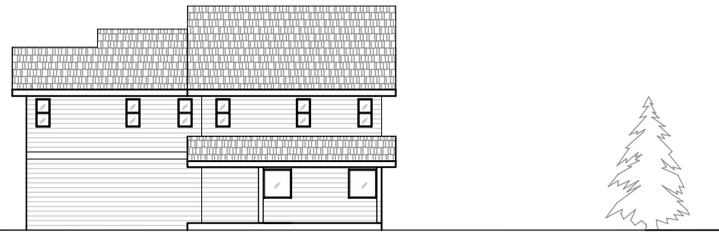


SECTION E

Scale: 1/8" = 1'-0"

North Elevation: Phase 1

South Elevation: Phase 1



North Elevation: Phase 2

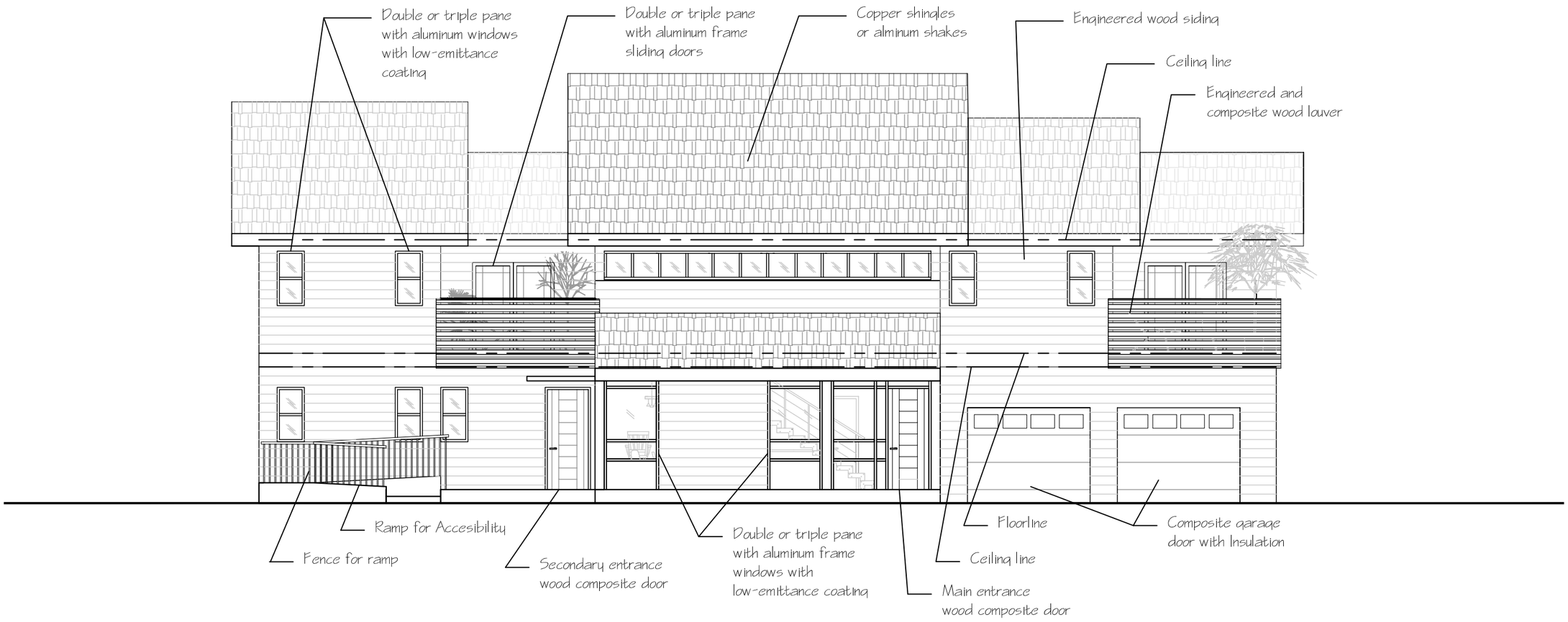
South Elevation: Phase 2

North Elevation: Phase 3, 4 and 5

South Elevation: Phase 3, 4 and5

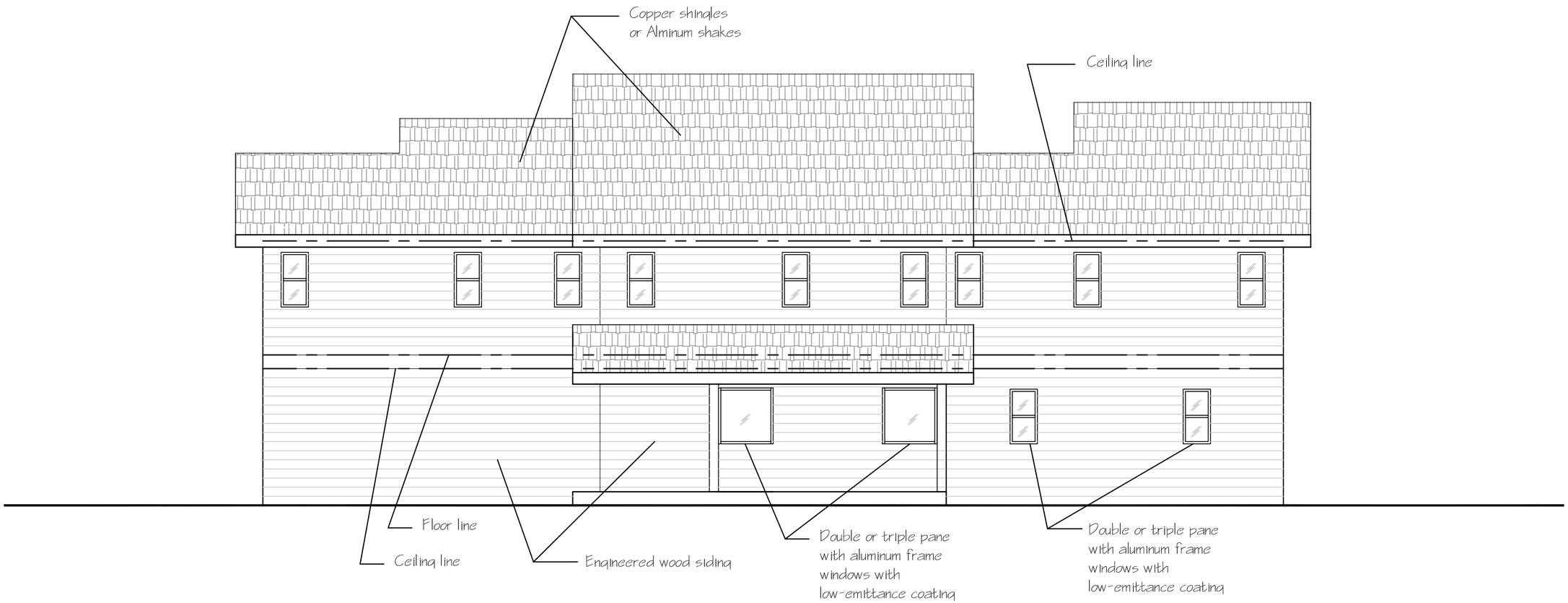
EXTERIOR ELEVATION

Transitions of Construction Phases



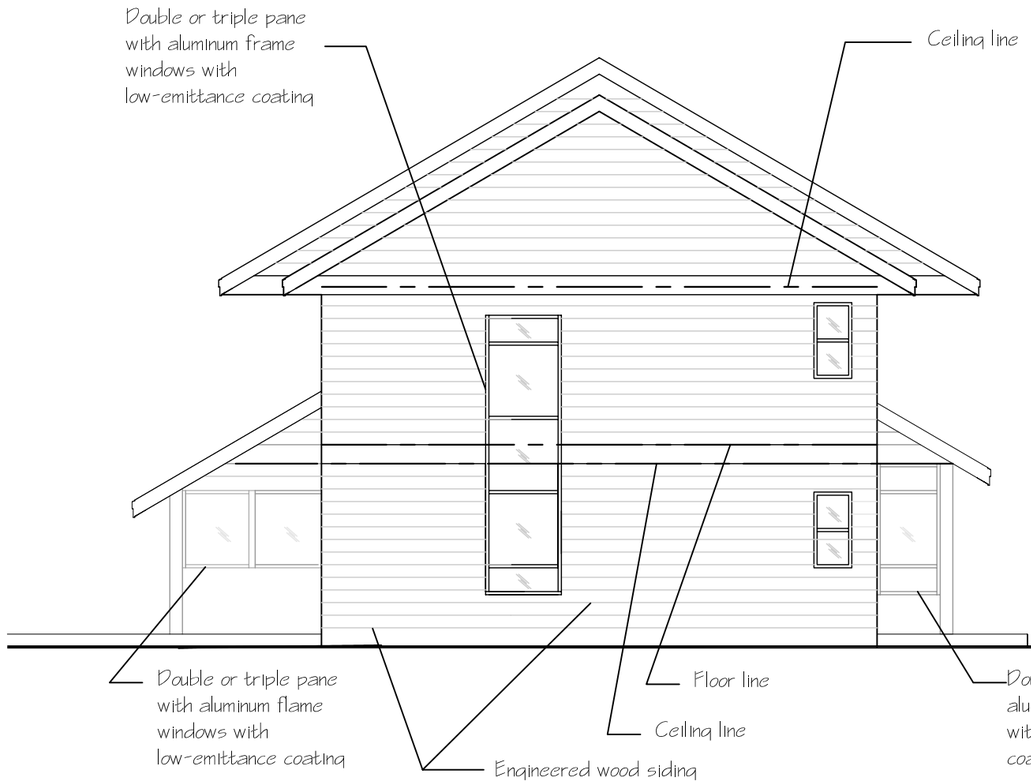
EXTERIOR ELEVATION: South

Scale: 1/8" = 1"-0"



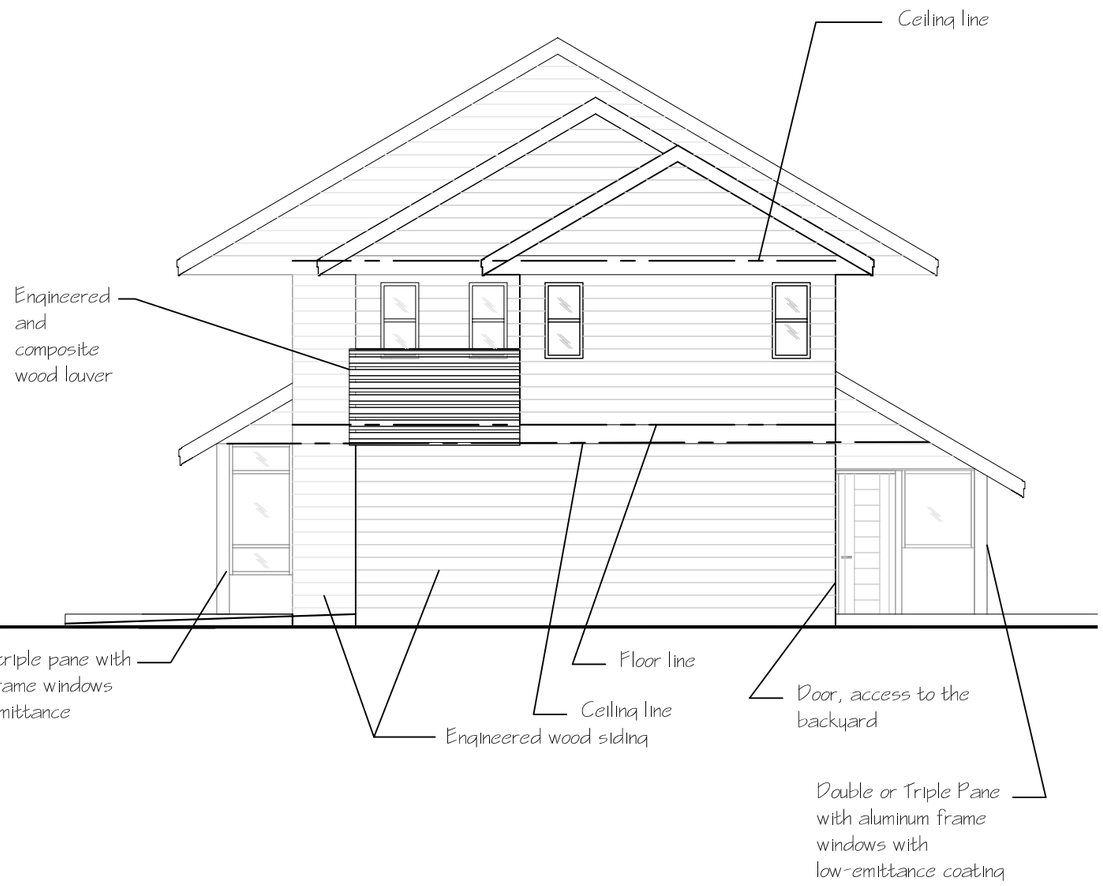
EXTERIOR ELEVATION: North

Scale: 1/8" = 1'-0"



EXTERIOR ELEVATION: West

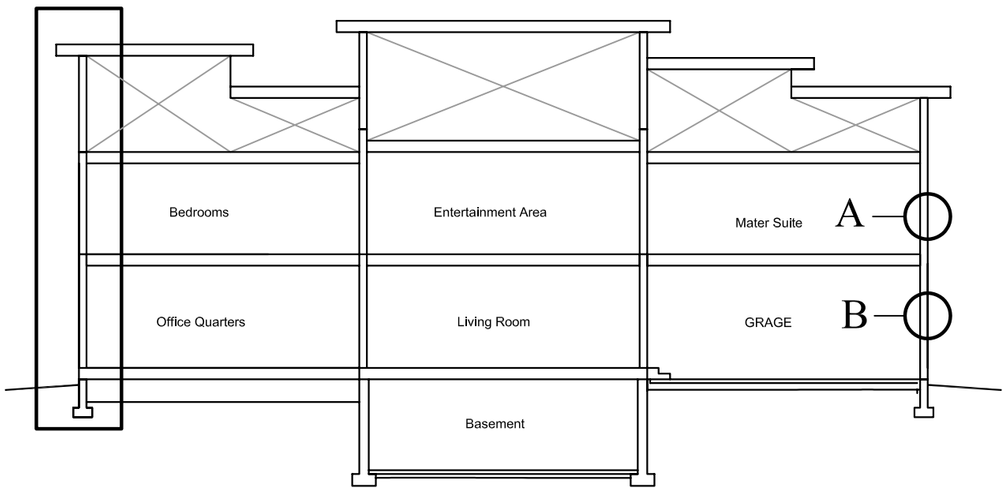
Scale: 1/8" = 1'-0"



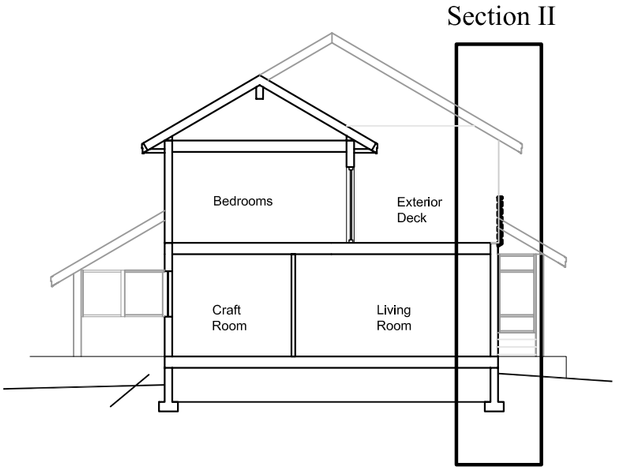
EXTERIOR ELEVATION: East

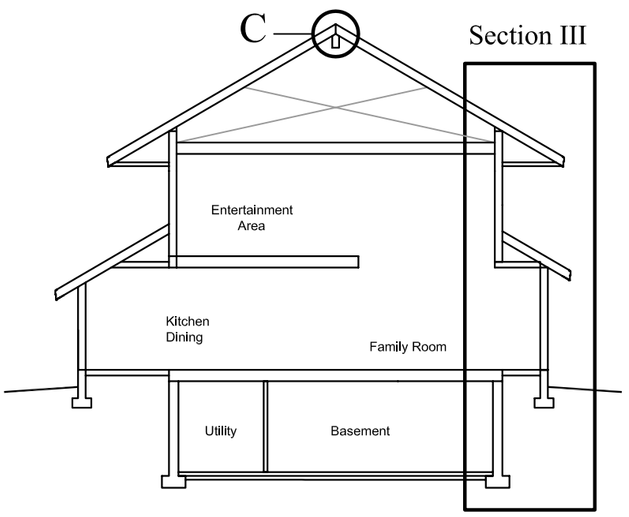
Scale: 1/8" = 1'-0"

Section I

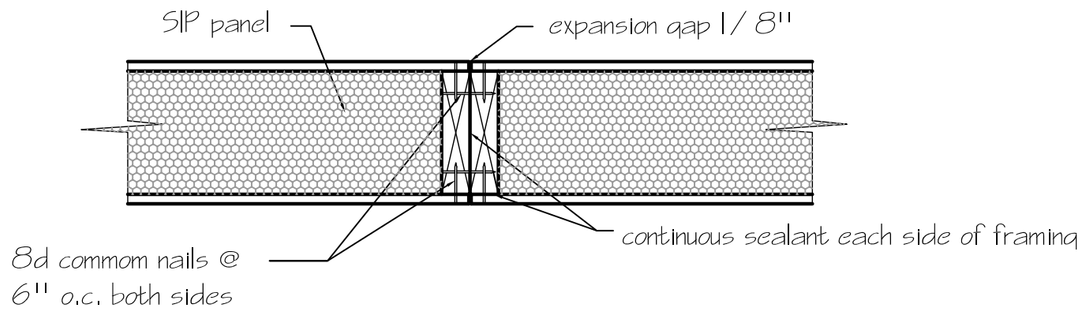


Section II



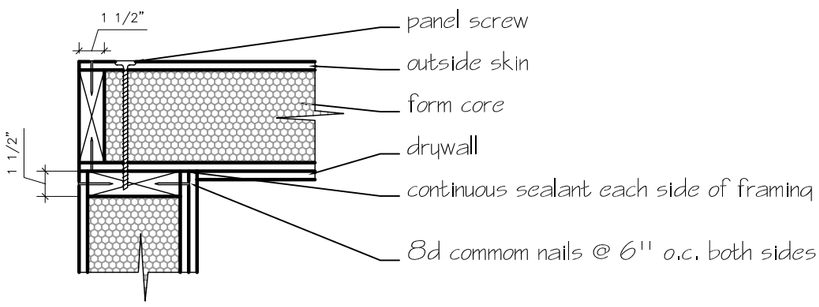


DETAIL KEY DIAGRAM



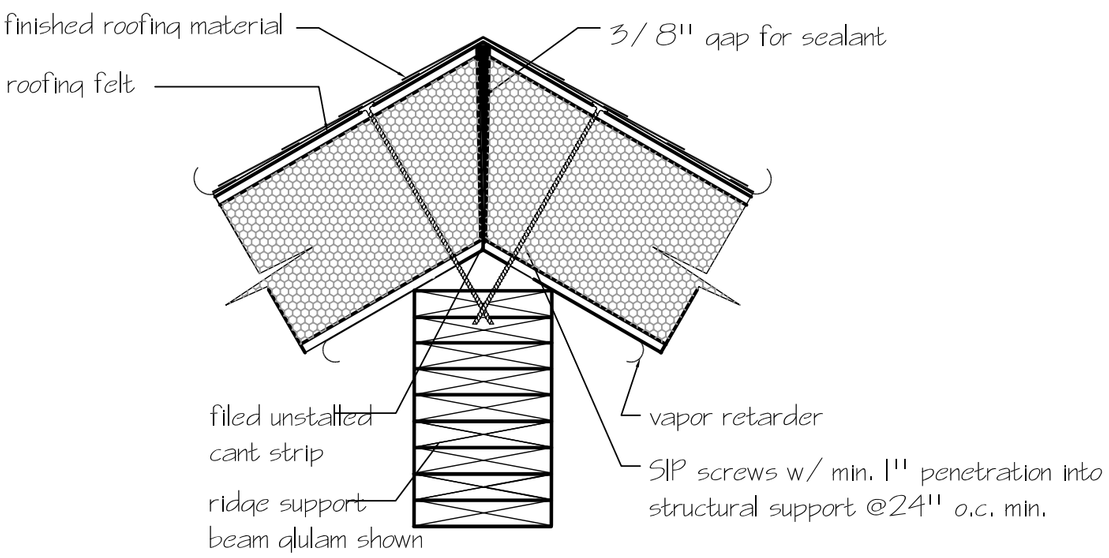
DETAIL A: Wall to wall panel connection

Dimensional lumber spline connection
Scale: 1-1/2" = 1'-0"



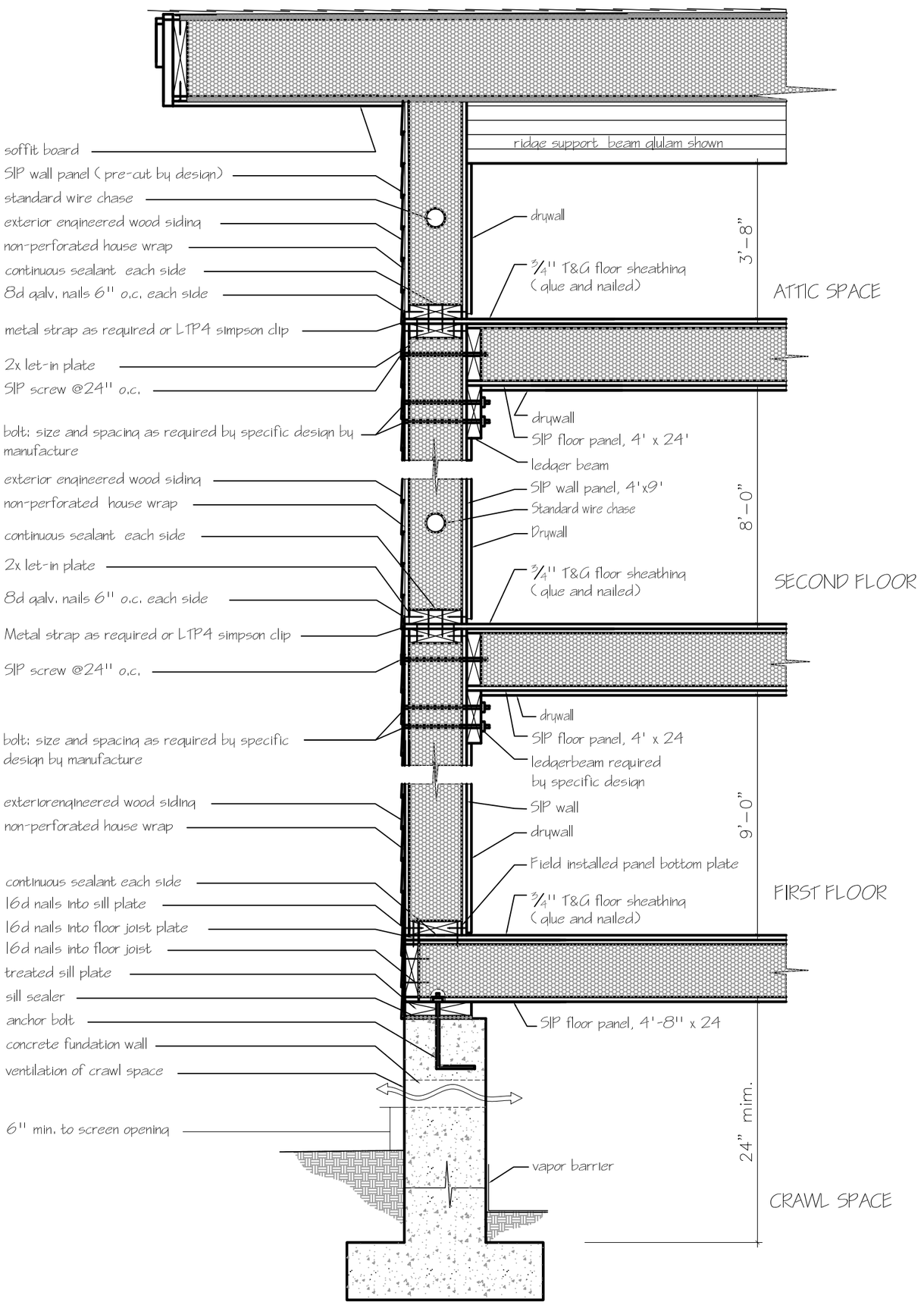
DETAIL B: Wall to wall panel connection

Corner wall connection
Scale: 1-1/2" = 1'-0"



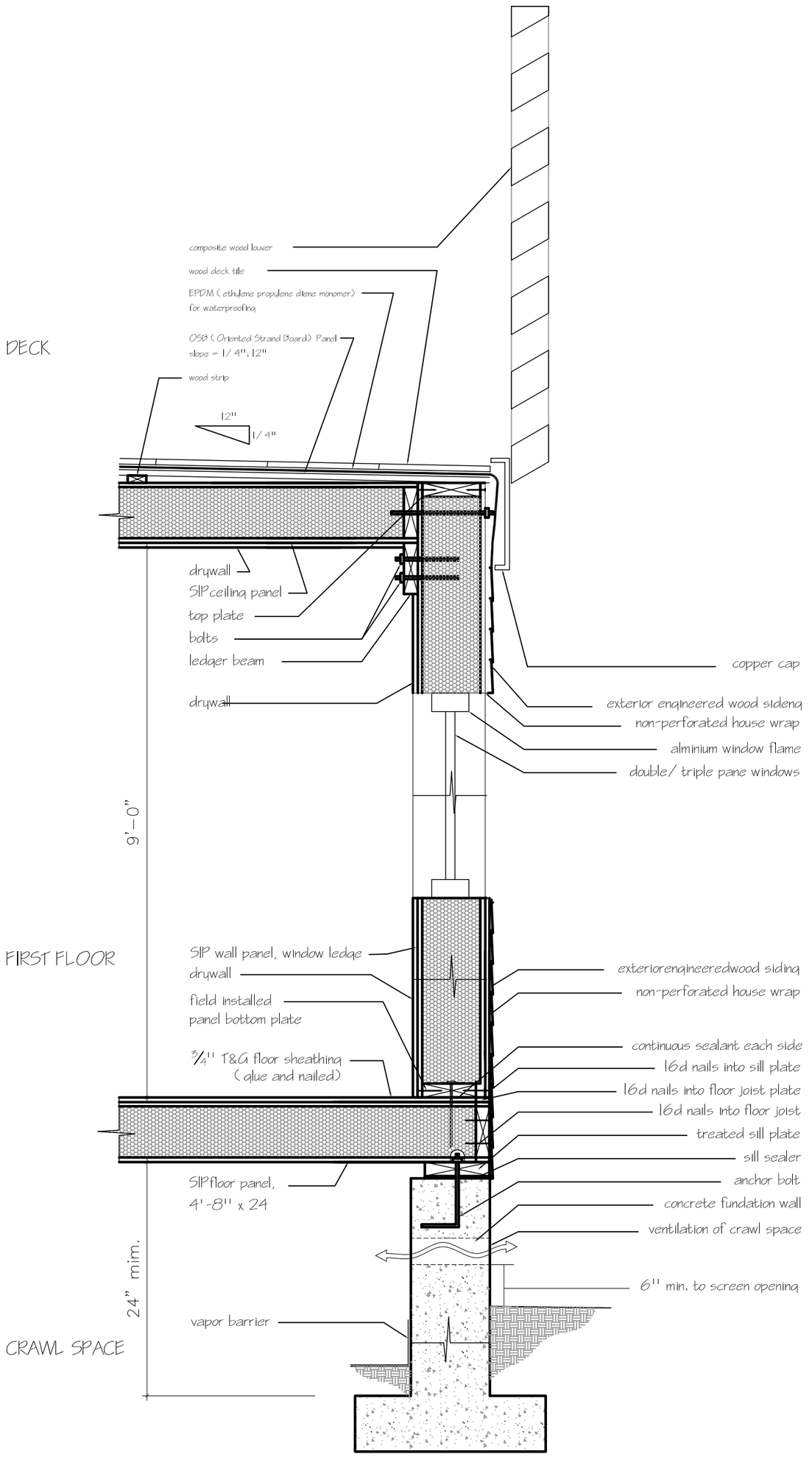
DETAIL C: Roof to roof conection

Beveled SIP ridge
Scale: 1-1/2" = 1'-0"



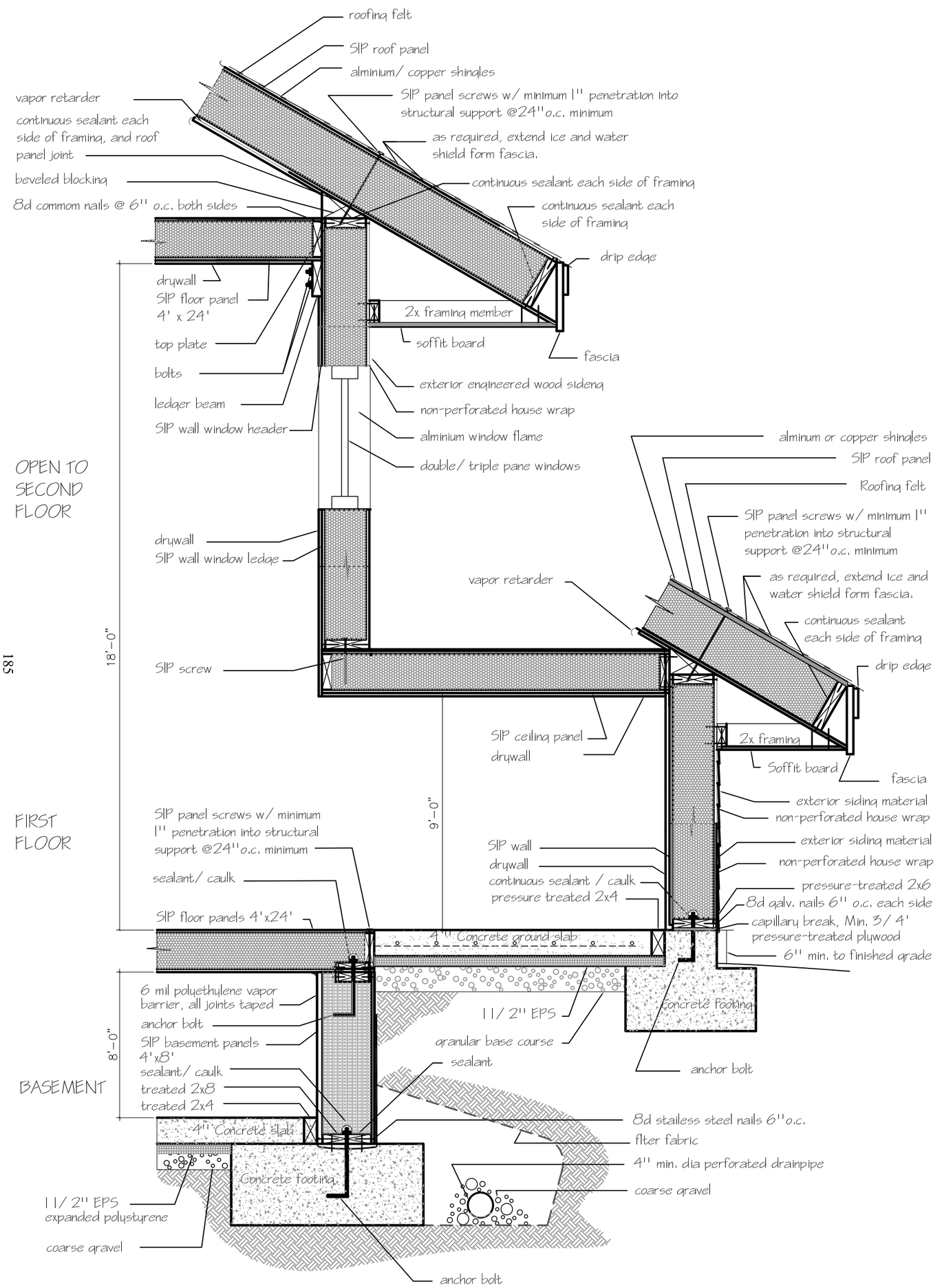
DETAIL: Wall Section I

Basment to roofing
Scale: 1" = 1'-0"



DETAIL: Wall Section II

Basment to deck
Scale: 1" = 1'-0"



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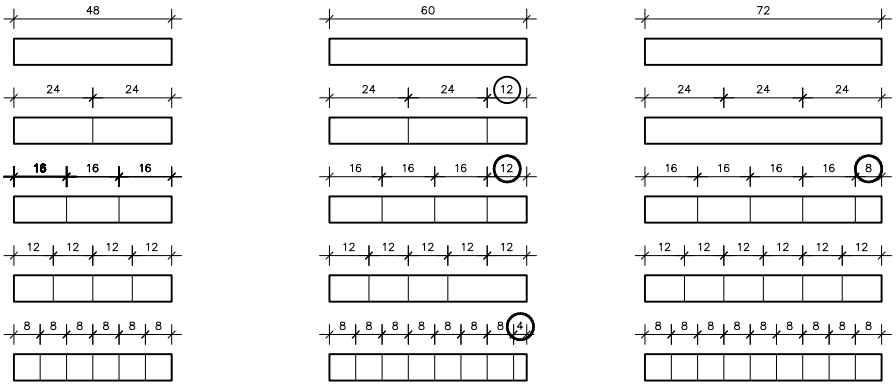
DETAIL: Wall Section III

Basment to roofing
Scale: 3/4" = 1'-0"

Choosing the 4-foot modular SIP panel

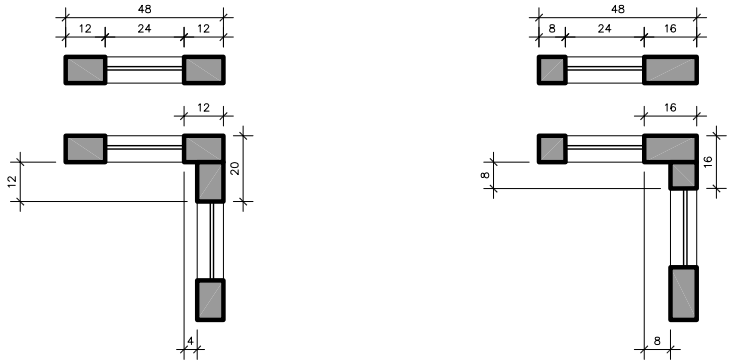


A 4-foot SIP panel was chosen because it is light enough to be lifted by 1 or 2 people without the use of heavy equipment, and because of design advantages.

4-feet = 48 inches which size is better able to accommodate traditional, in-stock merchandise and pre-fabricated products used at traditional construction sites, such as @ 24" o.c., @ 16" o.c., @ 12" o.c., @8" o.c., @6" o.c., than other available modular measurements. It also avoids paying for pricey custom fit materials.

In order for the modular system work effectively, it is very important to keep the numbers simple.

4-foot SIP wall panel with 2-foot window strategy



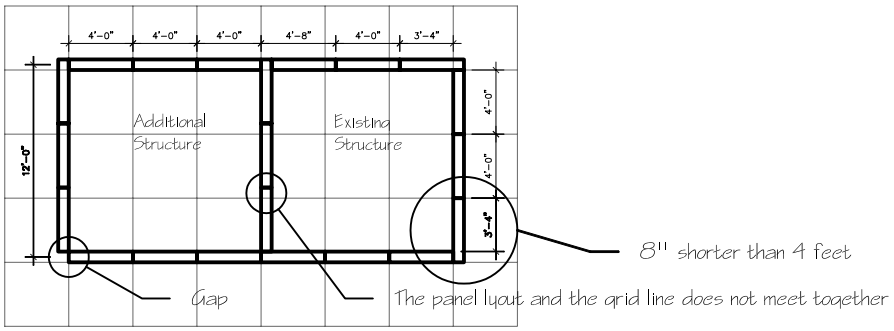
When designing a simple 2-feet window into the 4 feet SIP panel, rather than locating the window opening in the middle of the SIP panel, such as 12-24-12 inches, locate it slightly off-center, such as 8-24-16 inches.

By using the 8-24-16 measurements when placing window panels at the corner of the structure or rooms, the two openings of each window align equally from where the two corners meet; from exterior (16 inches each) and interior (8 inches each).

Solution 1

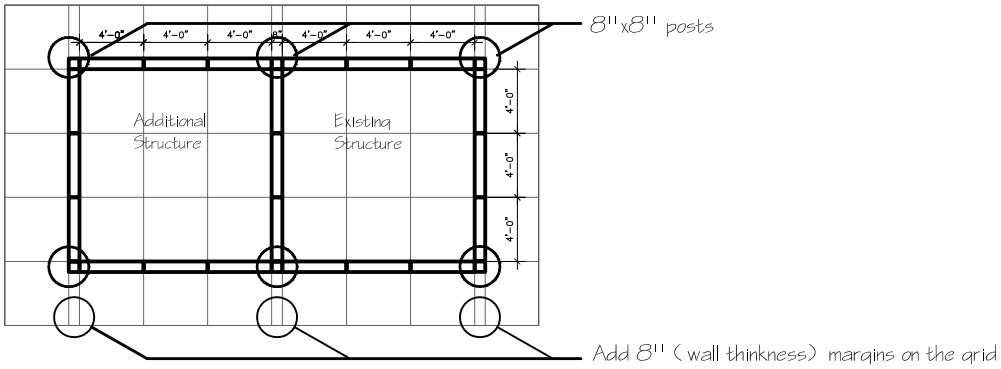
Modular System

Manufacture Recommended Panel Layout



Although the SIP manufacturer showed a sample of the panel layout, when an additional structure was added to the existing SIP panels, the grid line and panel layout did not meet and, therefore, caused problems

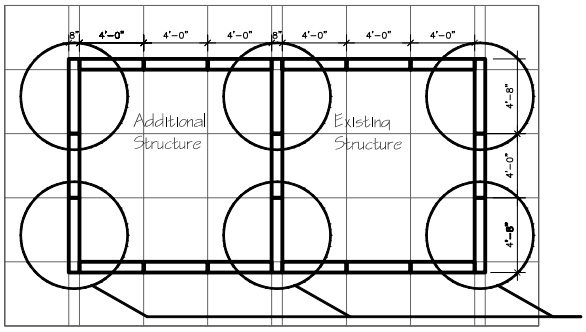
Solution:Step 1



To correct alignment, fill gap between the panels and adjust alignment of panel layout on the grid with an 8" margin added for the thickness of the wall on the grid.

Although the alignment is now corrected, to build a structure which is almost the same square footage, it requires 21-SIP panels + 6 - 8"X8" posts instead of using 21-SIP panels; and 12 extra connections were added.

Solution:Step 2



SIP panels do not require additional structural supports, therefore, it is not efficient to create Post + Panel structures using SIP panels.
Instead, two types of wall panels should be designed for the corner panels: 4'-0" and 4'-8".

Solution 2

Panel and grid layout

SECTION H
CONCLUSION

In this D. Arch. project, my goal was multi-purpose:

(1) To provide insight into how an architecturally designed prefabricated home can not only make available to homebuyers a "Home Within Reach," but it can also provide a great long term option for families.

(2) To propose a housing plan which promotes an adaptable home, designed and constructed to easily adjust to the evolving lifestyles of the homeowner.

(3) To propose a Prefab housing plan utilizing the latest advanced technology of the Structural Insulated Panel systems that promotes sustainable design.

(4) To demonstrate material that promotes sustainable design.

(5) To show how prefabricated housing will benefit the architects by providing a bigger opportunity to practice their skills to a wider market, and the homeowner who is looking for flexible and affordable housing.

I feel I have met my goals. My design exhibits the various ways the house can be altered economically to accommodate a family in its various stages of life; from first married to having children, to old age.

In the future, I would like to continue to learn more about the applications and construction techniques of the Structural Insulated Panel systems and Sustainable Design.

SECTION I
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